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On Stilts

By LEWIS WAYNE WALKER
and LAURENCE M. HUEY
Photographs by the Authors

MASTERS OF GRACE WHILE IN FLIGHT

The long legs measure more than twice as much as the length of the main body of the stilts. These birds are as appropriately named as some others are inaccurately named

MANY BIRDS are no doubt misnamed—such as the screech owl whose usual note is a quavering call; the sparrow hawk that lives mainly on insects—but not so the stilts, those strange waders of the marshland. In body size they match the killdeer, but leg-wise they have few competitors. Minus the neck and tail, the main body measures only four inches, while the legs reach down and down to a total length of ten. They are a "Ripley bird" if ever there was one!

Despite these legs and their seeming ungainliness, the bird is a master of grace. The long extremities are not dragged through the water but carefully lifted, moved and replaced with hardly a ripple to mark their passage. Foraging flocks of a dozen or more are a sight never to be forgotten. The thought of their nesting, of viewing them at close proximity, makes a Nature photographer itch to be out. He anticipates with pleasure the opportunity to be stiff and uncomfortable in a dark, wet blind for a twelve-hour stretch of daylight.

In years past San Diego County, California, was, no doubt, the home of countless pairs of these aristocratic waders. Ditch-draining projects, alien cats and target-seeking gunners drove them to less suitable habitats. Then improved roads laid bare their last strongholds. A decade ago it was thought that they nested in the County only sparingly. Naturalists did not expect them to make a comeback. After six or seven years their former coastal home had changed from an occasional oasis of solitude to a busy, constant line of traffic connecting Los Angeles and San Diego. Several years ago the stilts tried it again—a stone's throw from southern California's busiest highway. Strangely, that which drove them away—the rush of cars,

ONE OF THE NESTS DISCOVERED

After much hesitation and attempts to lure the blind away by the wounded-bird act, the stilts settled on the nests

the very traffic itself—seems now to be working for them and in a sense giving a form of protection. Gunners do not expect targets next to a boulevard, and roaming cats take their lives—all nine of them—in their paws when they cross this busy road.

About three years ago the first pairs raised their young and migrated away unphotographed. We wondered if they would return. The next year twice as many—six pairs—called Agua Hediondia (Dirty Water in English) Slough their home. There were still too few to meddle with photographically. We wanted them back in numbers. Last year we took our census and a score of birds wheeled and circled and tried to drive us off their salicornia-covered domain. A patient search rewarded us with six nests, some in beautiful situations. Early one morning blinds were constructed. Then came the wait; a wait filled with surprises.

A killdeer that had been plaintively calling from a distance of one hundred yards ventured closer, once we were concealed. Gradually she worked around to within thirty feet, then settled down on a slight hollow that contained three eggs. On the other side of the blind a least tern dropped to the ground, and, after holding wings aloft for a second, scurried to her three treasures a short way off. All around us there were birds in the midst of home duties.

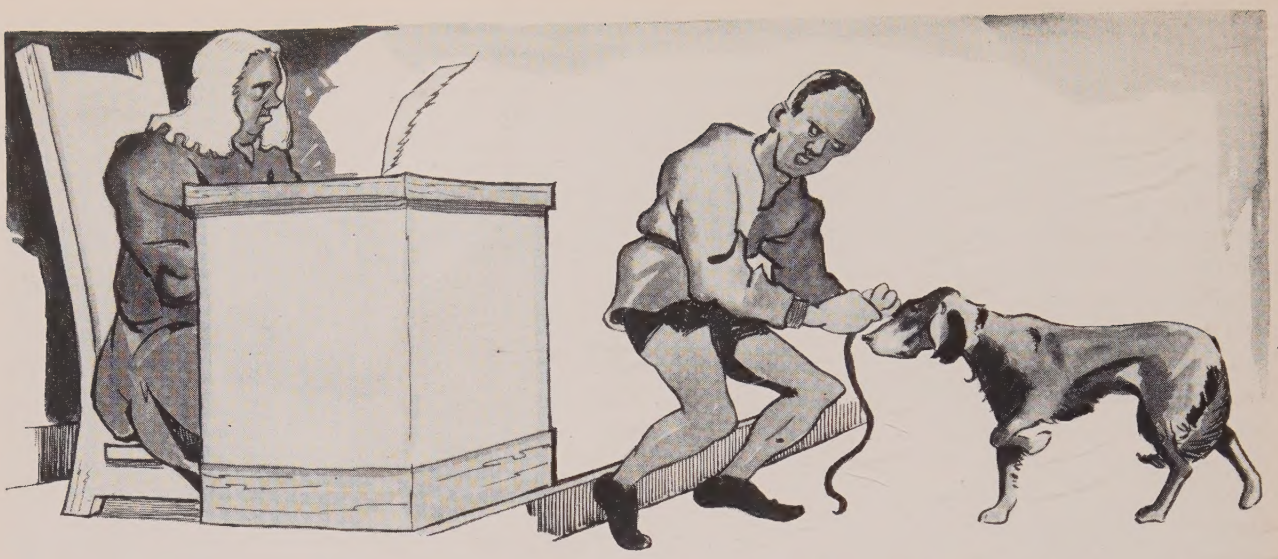
The stilts, however, were not so trustful. For hours they stayed at a distance and flaunted broken wings, wings that would miraculously heal when they realized our blind would not take the hint and run after a wounded bird! One of the birds most convincingly played that he had a broken leg. Every

three or four steps a reed-like red leg would collapse and down he would tumble. For a moment he would raise one wing, and, with muscles relaxed, let it blow in the breeze. Then up he would jump, walk a few feet and repeat. He believed in the adage "if at first you don't succeed, try, try again!"

Gradually the urge to incubate overcame fear and, one by one, the stilts settled down on their treasures. Cameras worked on the different poses from two blinds near two nests. Birds left and returned with breast feathers wet to dampen the eggs. A least tern dropped down with a tiny fish in its bill and gently gave it to its incubating mate. A killdeer, well able to fly but young, as proved by the string-like threads on the tail, walked within eight inches of the peephole in the blind. His appearance was a surprise to us as was our appearance to him and with a call of unmistakable meaning he was off. Tern and stilts rose in the air and immediately the blinds were again the center of suspicion. All the while we were busily focusing and changing film and cameras to take advantage of the partial acceptance that our blind had won from the marsh dwellers. However, all such days must come to an end. The sun was sinking low in the west. It was time to collect our apparatus, and be off, hopeful of photographic trophies.

THE PHOTOGRAPHERS' BLINDS WERE THE CAUSE OF A LOT OF SUSPICION

This bird was plainly fearful of the strange intruder, but was won over by the urge to brood her eggs



Medieval Animal Trials

By A. H. ALEXANDER

Illustrated by William F. Walter

A GROTESQUE tribunal convened in the ancient market place of Zurich in the year 1442. Robed magistrates and clerical dignitaries sat on an improvised dais in front of the courthouse; a withered beadle lifted the black wand of his office and cried "Bring forth the accused!" Imprisoned in a cage of heavy osiers, the accused was dragged in. He was a huge wolf, about to be solemnly tried for the killing of two little girls!

A learned prosecutor opened the case against the brute; an equally learned attorney defended it. Legalisms flew back and forth, authorities were quoted, witnesses testified against the shaggy prisoner. At length he was found guilty and was condemned to die by hanging on the public gibbet. Amid the leaping and huzzahing of the multitude, sentence was executed, and the—to us—strange case of *People vs. Lupus* was brought to a close.

Animal trials rank among the most fantastic ceremonies of the Middle Ages. Nor were they uncommon; one legal historian lists 200 of them in a single century. Almost every kind of creature was tried: mice, flies, hogs, cattle, horses, snails, fowls, dogs, worms. To the modern mind the trials seem grotesque and inexplicable—extreme manifestations of medieval superstition. Law and folk magic fused incongruously when dumb animals went on trial for their lives. Apparently, the medieval mind believed that these animals were possessed of the devil—or, as it sometimes appears—were the devil himself, masquerading as a sow or goat. Often, the trials were merely sadistic spectacles in a day when entertainment was both brutal and scarce.

Witness the bizarre performance in the old Norman town of Falaise in 1386, when a pig was tried for killing and eating an infant. The trial was made a festive occasion, with the whole populace turning out. The court gravely decided that the pig should be beheaded. The luckless porker was then dressed in human clothes, and was whipped and maimed before being brought to the block. Dressing the pig in clothes is the detail that gives such a spectacle its peculiarly medieval touch. In some cases the bedecked offender was hung on a gibbet.

Holding animals legally responsible for their crimes did not originate in the Middle Ages. "If an ox gore a man or a woman that they die," says a law of Moses in *Exodus,* "then the ox shall surely be stoned." Plato in his "Laws" prescribed that: "If a beast of burden or any other animal shall kill anyone, except while the animal is competing in the public games, the relatives of the deceased shall prosecute it for murder."

It remained for the Middle Ages, however, to give these concepts their wierdest expression. In 1314, at Moissy, a bull escaped from an enclosed pasture and gored a man so severely that he died. The animal was imprisoned in the town jail along with the human prisoners, as was customary with larger animals, brought to trial, and sentenced to be hanged. The judgment of the court was confirmed by the parliament of Paris, and the bull's execution took place on the town gallows. In 1499 another bull was hanged in the lordship of Cauroy, which belonged to the Abbey of Beaupré. Its crime, as stated in a record more voluminous than that of many modern cases, was "the furious slaying of a young boy of 14 years of age."

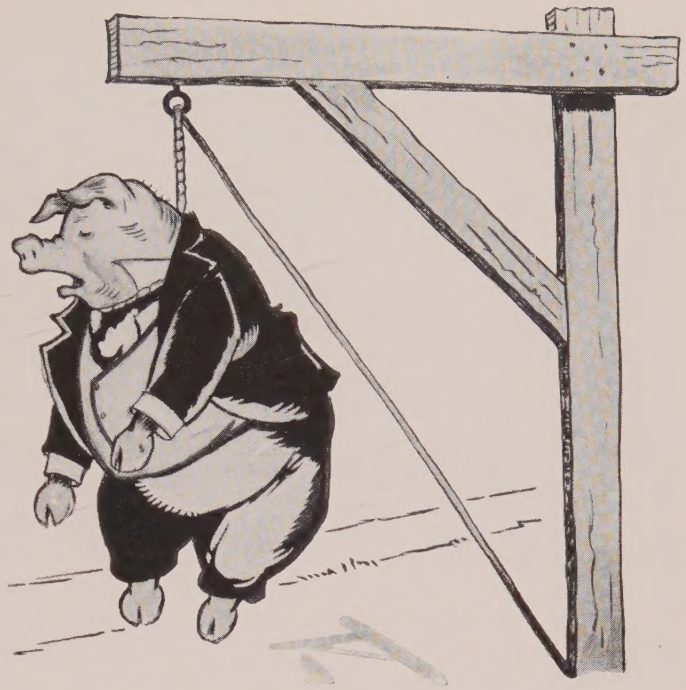
All manner of legal technicalities were invoked in these animal trials. The son of a young Burgundian swineherd was killed on September 5, 1370, by three sows who seemed to have feared an attack on their young. All members of the herd were arrested as accomplices. But the owner pointed out that the three sows alone were guilty; the rest ought to be acquitted. The Duke of Burgundy, impressed by the plea, delivered his judgment that only the three sows and one young pig were to be executed. The others were set at liberty "notwithstanding that they had seen the death of the boy without defending him."

Infanticidal swine, it happens, were the commonest offenders among domestic animals. In the Middle Ages

(as even now in some places) these animals roamed freely in the towns and villages and were a sort of sanitation department, to be found wherever there was garbage or filth. They were so ferocious that a small child was not safe in their presence.

At Sevigny in 1547 a sow and her six little pigs were tried for killing and eating a child. The lawyer put up such an effective defense that only the sow was executed, the offspring being exonerated on the ground that they were young, and their mother had set a bad example. Three weeks later, however, these same six little pigs were again in court, because their owner refused to give bond assuring future good behavior; he was afraid that the maternal criminal trait would eventually show up in them.

The courts of Dijon condemned and executed a horse for homicide in 1639, and a mare was burned to death in Aix as late as 1694 by order of the highest judicial tribunal of the province. Both animals were judged to be possessed by demons; testimony also proved that their crimes had been premeditated, and that they had mulled over their victim's fate long before delivering the homicidal kick!



A particularly savage bear that had ravaged Schwarzwald villages for many years was finally captured in 1499 and, like any desperado, brought to trial. A lawyer appointed to defend the animal raised the awkward technicality that it must be tried by a jury of its peers. This delayed the trial for many weeks while the point was argued. Finally the wrath of the people could no longer be restrained; the bear was brought into court in chains, and amid terrific bellowing was sentenced to be suspended from the public gallows and stoned to death by relatives of the persons he had killed.

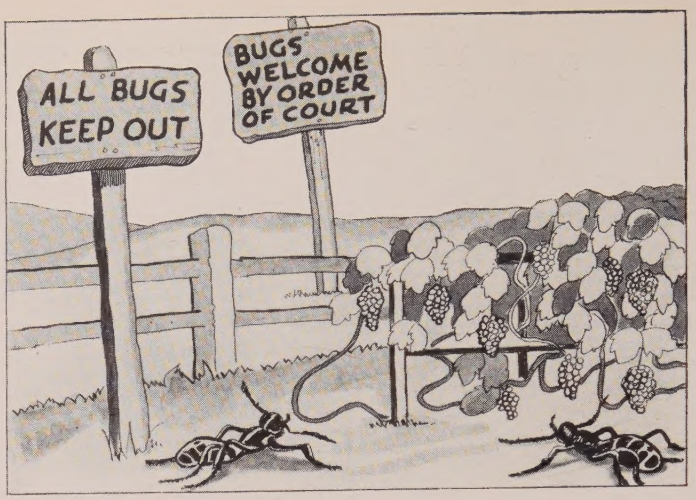
In these trials a sharp technical distinction was drawn between domestic animals and wild animals; the latter category included insects. Domestic animals could be easily arrested, tried and convicted. They came under the jurisdiction of the civil courts. But it was not possible to seize insects and rodents in large numbers and the civil authorities therefore demanded the intervention of the church and the exercise of its supernatural functions. Thus, when rats, mice or beetles were an annoyance to the community, an ecclesiastical court would take up the matter and name a commission to investigate the nature and extent of damage done. It also appointed a legal staff for the defense. A summons was drawn up and the animals were cited three times. If they failed to appear in court a judgment was delivered in default. The court would then issue an order that they quit the area or face further prosecution. It was customary, also, to catch several specimens of the culprits, bring them to court and solemnly put them to death while an anathema was pronounced upon their fellows. Very often these practices were followed by an increase in the pests rather than by their riddance, but this usually was blamed on the sins of the people or on the influence of Satan rather than on the impotence of the courts.

But medieval writers would have us believe that these edicts were sometimes obeyed by the animals. Felix Hemmerlin, famous Swiss lawyer who died in 1457, records that a bishop of Lausanne had prevented eels in Lake Lemon from swimming beyond a restricted area. The eels had become so numerous that they seriously interfered with bathers. When, 200 years later in Hemmerlin's time, the same lake harbored such a large number of leeches that they threatened to destroy the salmon, no leniency was shown. The offenders were tried in court, sentenced, and summarily banished! Where? The record fails to say.

A certain leniency in banishment was granted the field mice of Stelvio in the Tyrol. Against them in 1519 the people had made legal complaint that they had ruined their crops by "burrowing and throwing up the earth so that neither grass nor green thing could grow." Witness after witness testified to the damage wrought. But the lawyer for the mice related all the good they had done; how they had enriched the soil by their burrowing, and fed on harmful insects and larvae. If his clients were to be banished, he argued, the court should assure them a safe journey to their place of exile, protection while in transit from cats, dogs, and other natural enemies. And so, it seems, it was done, for the judge in his sentence of banishment added that "a free safe-conduct and an additional suspension of two weeks be given to all those mice who are pregnant or are still very young."

The great French jurist, Bartholomew Chassenée, made his reputation when, as a young lawyer, he was appointed by the court to defend rats accused of having destroyed the barley crop of the province of Autun. In view of the notorious guilt of his clients, Chassenée was forced to use all sorts of legal shifts and pleas. Thus, when the rats failed to appear in answer to the first summons, he argued that the citation had been too local and that, since the case involved all the rats of the diocese, all of them should

be summoned. When the court directed that this be done and when again the rats failed to appear, their lawyer explained that the court had not allowed enough time; the rats were very many in number, including the old and sick, and he therefore asked for an extension of time.



Once more the rats paid no attention, whereupon Chassenée, arguing that a citation implied protection of the individual on his way to and from court, explained that his clients were afraid to stir out of their holes because of "evilly disposed cats" belonging to the plaintiffs. It was only fair, he added, that the plaintiffs put up a heavy bond, to be forfeited if his clients were molested. The court considered this a valid plea but the plaintiffs refused to put up a bond and the case was dismissed. The rats were saved, and Chassenée's reputation made.

Animals were not only penalized for crimes, but if they were unfortunate enough to be born freaks they had to suffer the fate of the witch or heretic. In 1474, on a hill near Kohlenberg, a rooster was condemned to burn at the stake "for the heinous and unnatural crime of having laid an egg." The order for the execution had been given by the dignified magistrates of Bâle. The burning was carried out with the utmost solemnity and was viewed by a tremendous crowd. A similar burning took place in Switzerland as late as 1730. In the Middle Ages sexual aberrations of both man and beast were considered a sure sign that Satan was at work, and the best way to get rid of a devil was to destroy the body wherein the evil spirit dwelt.

In 1712 a drummer's dog in an Austrian garrison town bit a member of the Municipal Council in the right leg. The drummer was sued for damages but refused to be responsible for the dog and delivered it for justice. Whereupon the dog was sentenced to one year's incarceration in the pillory in the market place, in which all evil-doers were confined. Even mad dogs were formally tried and convicted as murderers by a legal tribunal. This may seem, at first glance, more humane than our present practice. But wait! It was expressly stated that a mad dog should not be allowed to plead insanity but should be punished with progressive mutilation, corresponding to the number of people or animals it had bitten, beginning with the loss of its ears, then including the tail, and extending to the crippling of its feet. *After* these barbaric tortures were over, the animal was then legally killed. During the trial itself, the rack and other torture devices were at times used on animals to extort confessions. Squeals and cries of pain from the tortured beasts were confession of guilt.

On the other hand, animals were readily accepted as witnesses in the courts: one man who was accused of having committed a murder in his own house, appeared before the tribunal with his cat, dog and rooster. When he swore in their presence that he was innocent, and the animals made no remonstrance, he was acquitted. If the man were lying, the Lord was supposed miraculously to give speech to the dumb animal, rather than permit a murderer to escape justice.

Practically every animal has had its day in the medieval courts. Black pigs, cats, goats and dogs went to trial with the scales of justice strongly tipped against them, for black was thought to be Satan's favorite color and characteristic disguise. Snakes and cats, mixed, or separated, were sometimes hung in wicker baskets and burned over public bonfires—all with a legal aroma, of course.

A famous series of insect trials involved depredations on a valuable vineyard in France in 1545. The first trial was ended by agreement of the contending counsel when the offending hordes suddenly vanished. Forty-two years elapsed before a second visitation. The human contenders in the case were dead, so it was necessary to engage new lawyers on both sides. After interminable discussion, it was finally decided to allot a plot of ground outside the vineyard to the insects. The lawyer for the pests opposed this decision on the ground that the plot was too barren. While the trial dragged on the insects, of course, ignored both permissive and restrictive signs. The records of this trial are still preserved in the archives of St. Julien, but the final outcome is unknown to us. That the final verdict was unfavorable to the marauding pests, perhaps, may be inferred from the fact that the last few pages of the record were chewed up by weevils.

In mediaeval writings on jurisprudence one finds constant reference to the problem of whether animals should be held legally responsible and punishable for their crimes. Most authorities agreed that they should. Jean Duret in his detailed work on Pains and Penalties makes this statement: "If animals not only harm but kill and devour any person, as has occurred quite frequently in cases of small children being eaten by hogs, they should pay the penalty with their lives and be condemned to be hanged and strangled, in order to wipe out the memory of the enormity of the crime."

No rational explanation has ever been advanced for medieval animal trials. Were they, like the *auto da fé*, orgies of superstition and sadism—or have they a basis in the still murkier depths of totemism and taboo? Some writers believe that the spectators unconsciously identified the animals with the bestial part of themselves, and that the suffering of the condemned creatures was a vicarious atonement of human guilt; a cleansing process.

YOUNG YAKIMA INDIAN WOMEN PICKING THE WINTER SUPPLY OF BLUEBERRIES. THE BASKETS ARE OF CEDAR ROOTS AND SPLENDID EXAMPLES OF MODERN BASKETS PATTERNED AFTER THOSE OF EARLIER DAYS. PHOTOGRAPH COURTESY UNITED STATES FOREST SERVICE

(Below) Larkspur, one of the wild flowers frequently used in the making of charms. The leading charm makers guard the secret of their concoctions most jealously. Photograph by Asahel Curtis

Nature and the Northwestern Red Man

Many plants still used in making charms and "medicine"

By HEISTER DEAN GUIE

WILDERNESS plants, vital to the existence of the aboriginal inhabitants of the Pacific Northwest interior, still play an important part in the lives of their descendants.

From the great conifers to the rarest of herbs, the native flora continues to meet various wants and needs of today's red people in the vast Columbia River drainage area. In spite of changes wrought by civilization, the Indians retain many ancient beliefs and customs, and few have abandoned entirely the lore of their ancestors.

The Yakimas of south central Washington, their Shahaptian stock cousins, the Walla Wallas and Umatillas in northeastern Oregon, and the Nez Perces of Idaho and the Colville reservation in northeastern Washington, the Salish-speaking Okanogan group tribes on the Colville and in British Columbia, and others north and south of the international boundary, cherish traditions of stone age antiquity.

While indigenous plants that were sources of sustenance and materials essential to crafts and industry in primitive times have been superseded in large measure by products of farm and factory, the utilization of such wild products is still widespread. The nutritious bulbs of the blue-flowering camas, the bitterroots, wild onions, the cow parsnips, blueberries, service-berries, and choke-cherries are gathered in quantities. Mats for floor and wall covers are made from rushes and tules; baskets from cedar and spruce roots. Bags are woven with native hemp twine.

More or less familiar to neighbors of the first Americans are these and other practical uses of the plants of mountain, plain and valley. But few white persons are aware of the extent to which the latter draw on the vegetable kingdom for purposes beyond and above the strictly material.

Inspiring symbols of the majesty of Nature, the stately firs are credited with possessing strong supernatural power, as well as properties that cure certain physical ills.

The Indians make themselves "strong," as they express it, by rubbing their bodies with soft tips of the green boughs while bathing. This procedure, they believe, cleanses them spiritually and is a powerful aid to whatever prayers they offer to the unseen powers. It is deemed especially effective during a sweat bath, since the sweat lodge—given to the people, legends tell, by the Creator back in the beginning of things—is a sacred institution.

In fir country the floor of a sweat lodge usually is strewn

DRYING BANKED BLUEBERRIES BEFORE A FIRE IN A TRENCH. AMONG OTHERS, THESE ADD TO THE INDIANS' MENU. PHOTOGRAPH COURTESY U. S. FOREST SERVICE

with small, leafed branches of the tree, and others may be placed overhead, between the arched willow ribs and the blanket covering of the diminutive hut. Like the materials of which the lodge is constructed, and the heated stones on which cold water is dribbled to produce steam, the branches acquire holy significance. They are most potent "medicine."

Appealing to the Person Above and praying also to his guardian spirit—asking, perhaps, for success in hunting, fishing, gambling or wooing, or for relief from sickness or other trouble—a naked, crouching bather breathes the hot incense of the fir and mops his perspiration-drenched skin with green fir twigs. He rids himself of all evil, and his spirit is uplifted. And when, after immersion in a nearby stream, he relaxes in the sunshine, a feeling of goodness permeates his being.

Held in highest esteem as a "medicine tree," is the great silver or white fir, with the Douglas fir a close second. In some localities young girls follow the age-old practice of stroking feet and ankles with white fir branches, so that they will be small and shapely and never tire. They likewise brush their hands to keep them small, and their faces that they may be beautiful. Reliance is placed on the pungent fragrance of the white fir to protect feather finery, furs and woolens from moths; green twigs are packed away with clothing and regalia subject to ravages of the larvae.

The Douglas fir is valued as an agent for the easing of rheumatic pains and muscle cramps. Small pieces of hot charcoal processed from the tree are laid on the region affected. A less heroic treatment is the application of the heated green branches. A drink made by boiling young fir twigs with their leaves is a favorite tonic.

On a par with the firs as a medium for spiritual purification is the bald-hip rose, *Rosa gymnocarpa.* The larger branches serve as brooms for sweeping out a grave before a burial—to prevent the shade of the deceased from loitering in the vicinity and annoying people. After a funeral, the undertaker, who is a medicine man, and the surviving relatives undergo steam baths to remove "contamination" with the dead, and wipe themselves with rose twigs and leaves to make the result more certain.

Medicinal products of the bald-hip rose include a tonic obtained by boiling the stems and an eyewash decocted from the bark. The fruit of the rose is eaten. In olden times the rose-hips, commonly called "famine food," were dried and reserved for emergency winter rations.

Prized for its supernatural power is the nettle. A hunter who thinks that his rifle has lost its power to kill will boil the stems and leaves of this "stinging plant" and fill the barrel (which has been plugged with tallow at the breech) with the brew. After the gun stands overnight it is ready for service again. A rifle, the Indians believe, may be rendered absolutely useless if certain taboos are violated, as, for instance, if it has been touched by anyone who has suffered a recent bereavement and has failed to take the prescribed number of purifying sweat baths. It happens sometimes, too, they say, that an enemy, by incantation, steals the power of a gun. In this unfortunate condition the rifle may shoot, and shoot straight, but it cannot kill anything.

Besides "doctoring" a weapon, the owner may treat himself to a draught of the nettle decoction before each meal for several days, and take one or more vapor baths, each followed by a nettle liquid wash. These added precautions are considered necessary if the hunter fears that he has been subjected to contamination, or has broken one of the taboos. The deer, elk and other game easily avoid a contaminated person, or one who has violated rules of the hunt.

Should a nettle patch not be at hand, the false-hellebore does nicely as a power restorative. The roots are sliced and boiled for several hours, and the dark liquid is poured, still warm, into the bore of the gun.

Other plants, including the bald-hip rose and loco weed, also are employed in the making of brews for ailing guns. The various magical concoctions are used, too, as washes for fishing equipment—nets, traps and spears—to vanquish evil spells and bring good luck. Bows and arrows formerly were doused for the same reason.

How many kinds of plants go into the manufacture of charms no one knows except the comparatively few top-notch charm makers, and they will not tell. Among the commonest are the red and yellow columbine, larkspur, shooting star and the bitterroot, the same *Lewisia rediviva* whose roots, cooked, are eaten with such relish. The bitterroot and columbine are said to bring good luck in gambling, and the columbine, larkspur and shooting star get in their best work when compounded into love charms.

Charms may be made wholly of plants or their parts, of animals or animal parts, of minerals, or of combinations of vegetable, animal and mineral elements. They usually are kept hidden from profane public gaze, and ordinarily are worn on the person, perhaps carried in small buckskin sacks. Some individuals depend on talismans of their own contriving, or on odd-shaped or prettily marked pebbles that strike their fancy, but the majority buy their charms from persons who make a business of compounding them and know the fine points.

COURTESY YAKIMA INDIAN RESERVATION

NATURE PROVIDED THE MATERIALS

Exhibit showing Indian hemp plant; hemp bark, which is used for weaving; twisted hemp; corn husks for ornamentation, and the finished products

Older men and women, particularly the latter, who possess strong mystery powers and have a special knowledge of the necessary ingredients—knowledge that may have been handed down through their families for generations—are rated the most proficient charm makers. Eager swains, lovelorn maidens and even staid matrons who want to retain or regain the affections of their mates, pay with money, horses, food, blankets, baskets or other goods for a few pinches of powdery stuff designed to promote affairs of the heart. Persons not concerned with the tender passion but desirous of increasing their wealth also are good customers of the charm makers.

The most valued love charm plants are daintily-flowered herbs, the rarest and hardest to find, that grow beside icy springs and rills in the high mountains, near timberline. Their identities are kept secret by the charm makers.

Taken with proper ceremony just at dawn or at sunset, the roots are shaved carefully and the shavings are dried and then pulverized with animal parts, as the tip of a bird's tongue, heart of a fool-hen, and maybe a cricket or two. Red facial paint often is added. The assembling of the ingredients may require weeks or months, and, of course, the person making the charm must take many purifying sweat baths to avoid human contamination of the precious elements and to enlist their aid.

If the mixture is used as a potion, a bit of it is sprinkled surreptitiously in food, drink or tobacco that is given to the one to be allured, while the owner of the charm whispers instructions to the magic substance and pleads his cause with it. Occasionally, the possessor of a charm, confident in more direct tactics, asks the object of his affections to smell the "medicine."

Equally effective, Indians assert, is conjuration at a distance—remote control. When ready to put the charm to work, the owner takes vapor baths or bathes in cold water on three consecutive days. Then, with his sack of magic powder, he repairs at sunrise or sunset to a stream and sits in the water, facing the sun. He prays to the sun deity to favor his venture and to the spiritual herb whose help is essential to successful culmination of the affair. Dipping a moistened finger in the contents of the sack, he crosses his arms and draws his hands across his chest until they meet over the heart, and, as if addressing the woman he seeks, tells her that she shall think of him as the sun goes down and will come to him with love in her heart.

With all their progress along the white man's road, the Northwestern red people's faith in the efficacy of charms, and their belief in the occult powers of wild plants, seemingly are almost as strong today as ever. It will be many, many snows before they no longer look to the firs and lesser growth for supernatural comfort and assistance. After all, faith is a most satisfying possession.

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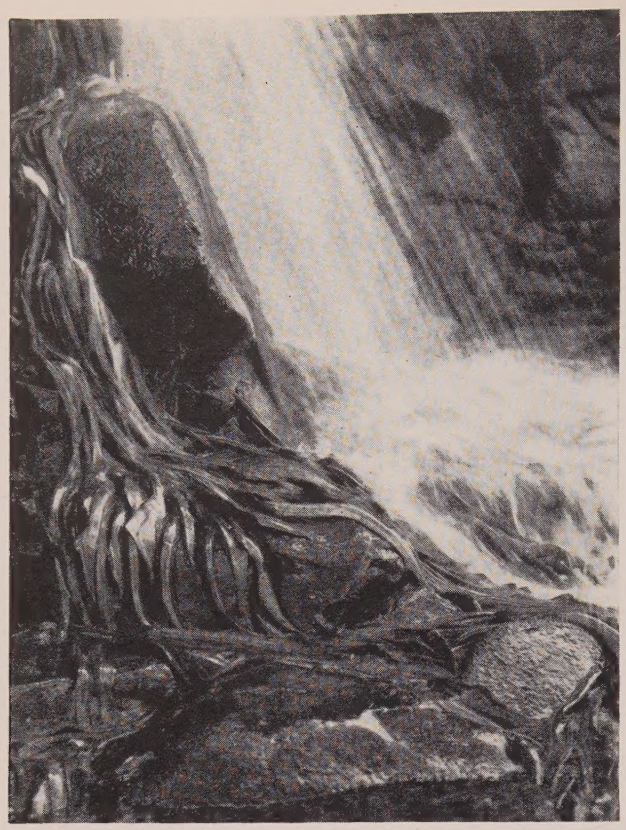
Winter Etching

By ELEANOR ALLEN

Here is crystal filigree
Hanging from a birchen tree;
Here is beauty of the frost—
Drink it quickly, or it's lost;
Delicate as fairy lace,
Silver etchings hold the trace
Of the winter's icy breath—
Soon the sun will drink their death!



Migration of the River Lampreys

The story of parasitic dwellers of the watery kingdom that are extraordinary in life and habit

By MILO R. CLARE

Photographs by the Author

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LAMPREYS CLING TO THE ROCKS

They follow up every watercourse, however small, even where obstructions in rivers, such as cascades, impede migration. In such places they congregate, often in large numbers, freely exposed to view and with only the splash of water to keep their skins moistened. They are found packed like sardines in a can

AMONG THE more interesting forms of migration is that type of mass return of the members of an animal species from distant areas, to which they have gone for a period, back to their ancestral breeding grounds for purposes of reproduction. Such movements are rigidly fixed as to season and route. When the journey is long and overcharged with hazards, the migrating individuals must pit their collective strength against the odds. Although the destruction of lives along the way may be enormous, yet the outcome is to be regarded as successful if a sufficient number of the participants push through to journey's end to serve the reproductive needs of the species.

Among the most readily observed migrations are those of such fishes as leave the ocean in early spring and ascend to the headwaters of rivers to reproduce. Much has been written about certain of these migrations, notably about that of the Chinook salmon of the rivers of the Northwest. Associated with the run of the Chinook salmon is another migration that has received scant attention—that of the river lampreys. This is probably due to the fact that these animals are held in low esteem, because they lack commercial value themselves and are destructive to fishes that do have commercial value. Yet their migration is spectacular and as remarkable as that of their betters.

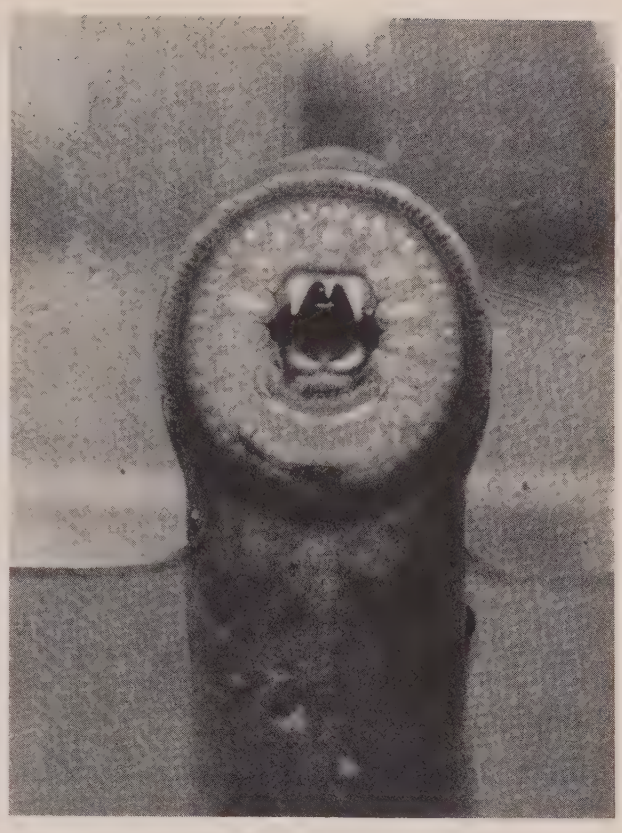
Today the migration of river lampreys is noteworthy only in the Pacific Coast streams, more especially the Columbia River and its tributaries. With dams and polluted watercourses barring them from ancestral breeding grounds, lampreys are practically gone from streams emptying into the Atlantic. Some thirty years ago immature individuals several inches in length were abundant along the Susquehanna River and were used extensively as bait for salmon fishing. Now these animals are practically restricted, on the Atlantic Coast, to a few New England rivers, where some are caught each year for scientific study. On the northwest Pacific Coast the lampreys continue to ascend the rivers each spring in numbers beyond computation, although river men say that the runs are smaller than formerly. With completion of the Bonneville Dam on the Columbia, it is probable that the runs will dwindle appreciably in the near future, threatened just as the Columbia River salmon run is threatened.

Lampreys appear in the Columbia River somewhat later than the vanguard of the migrating salmon. It appears probable that they accompany and feed upon the salmon multitudes congregated in the ocean opposite the mouth of the Columbia, and time their journey into fresh water when the converging lines of salmon begin the journey upstream. Although they do not feed while in fresh water, once started on their journey the reproductive urge carries them onward. The first lampreys of the season appear in the Willamette River, largest tributary of the lower Columbia, about the middle of May, and the migration attains its high point early in June.

The river lamprey is, in fact, a major parasite of the salmon, as well as of other large fishes, securing its sustenance from these much after the manner of a leech. Unlike other vertebrate animals, all of which possess hinged jaws for biting, lampreys and a few close relatives are entirely lacking in jaws, and have, instead, a circular, funnel-shaped mouth set with horny teeth. In the center of the funnel protrudes a rod-like tongue, likewise armed with teeth, which, moving back and forth like a piston, enables the animal to attach itself firmly by suction to a smooth surface. Thus attached to a salmon, the parasite hangs on

THE SUCKER MOUTH OF THE RIVER LAMPREY

It is surrounded by a fleshy rim and armed with numerous teeth, those at the front being robustly developed. In the photograph the tip of the retracted tongue may be seen in the center of the mouth. By retracting this the lamprey creates a suction enabling it to attach to a smooth surface, as to the glass wall of an aquarium in which this descriptive photograph was made



with large teeth located in front of the tongue, using the latter to rasp away the skin and flesh of the salmon and reach the blood on which it feeds.

The absence of hinged jaws in vertebrate animals is extraordinary and confers a special distinction on these animals and their kin. Scientists tell us that the lampreys are archaic animals surviving from a geological period when the type of jaw apparatus we see in fishes and in higher vertebrates had not yet come into existence. In fact, these animals carry into the present a body organization belonging to a time when the earliest vertebrates were in the making. Authorities classify the lampreys as a group distinct from the one containing the fishes. In fact, we can not properly speak of them as fishes.

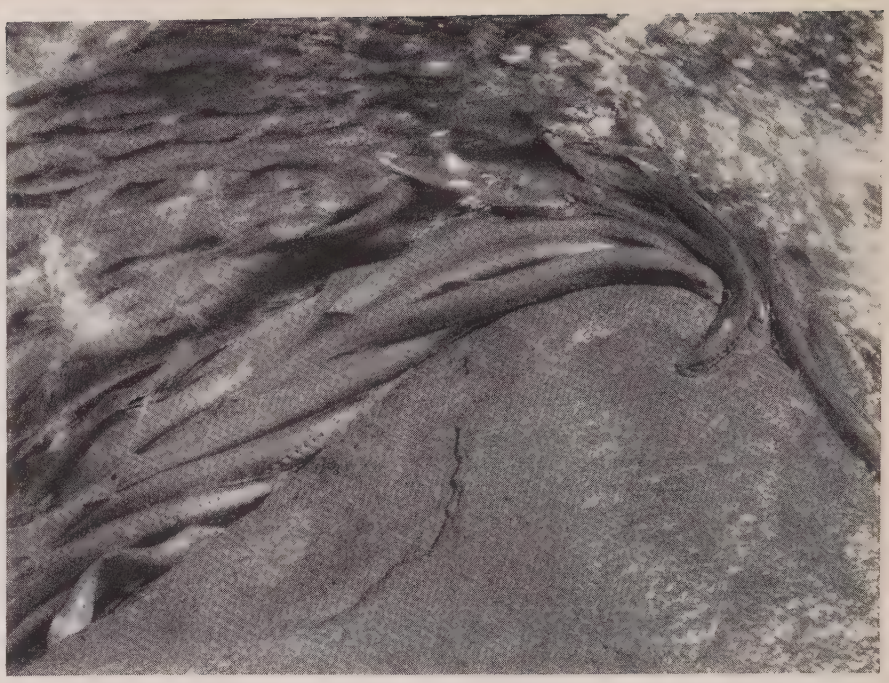
Migrating lampreys may best be observed at the foot of obstructions in the rivers, such as dams and waterfalls. There they accumulate in vast numbers, and have the ability to leave the protection of the water to ascend for short distances up vertical walls, using the sucker mouth. To climb, an individual will draw up his body, extend it suddenly, throw his head several inches higher, and clamp fast. Even under water, lampreys anchor themselves with the sucker mouth. At the falls of the Willamette above Portland, all of the river pools and the steps of the fish ladders are crowded with the undulating bodies, and the rocks at the sides of the numerous minor falls are festooned with them. Because of a tendency to avoid bright light, the lampreys gather in the gloom of spillways under the nearby paper mills. Trying to progress against the violent turmoil of water in these spillways, they cling to the water-drenched rock walls in such numbers that every square inch of surface seems covered with the sucker mouths. Their bodies, packed as tightly as sardines in a can, project nearly horizontally from the points of anchorage. Strike this mass with a pole and the air is tempestuous with slithering bodies and the spray thrown by lashing tails.

As the migratory tide attains its crest, many animals perish in blind channels; others die in rock pools where they have been isolated by the receding level of the river. As the bodies decompose, a strong odor of fish oil is released, creating a local nuisance. The simplest remedy appears to lie in aiding the lampreys to pass over the obstructions and in closing the blind alleys.

As the lampreys pass from the rivers into the smaller streams, they give evidence at once of the purpose that has brought them far from the ocean. In the stretches of smooth but swiftly-flowing water at the head of riffles, they excavate pockets, or "nests", in the gravel bottom. Attaching the sucker mouth to a small stone and swimming energetically, the animal lifts this until the force of the current is sufficient to transport the stone beyond the lower end of the excavation. Stones that must weigh as much as five or six pounds in the water are removed. If rocks are encountered that are too heavy or too firmly embedded to be dislodged, the entire project is abandoned and a new site is selected farther upstream. Much labor is done in making these excavations, and several abandoned nests occur at almost every riffle-head. The finished nest is three or four feet in diameter and about eighteen inches deep. The animals become paired in a purely accidental way. A single individual starts an excavation and is joined presently by others, until sometimes five or six animals are at work in one pocket. Eventually the superfluous ones move on, to leave a male and a female occupying the depression.

As the nest nears completion, the floor and sides acquire a lining of sand. In the sexual act the male lies alongside the female and loops his body more or less about hers. Eggs and sperm are emitted simultaneously, amid a violent lashing of tails that stirs up a cloud of sand. Fertilization occurring at once, the minute sticky eggs adhere to the particles of sand and are carried by them and anchored to the floor of the nest. After the reproductive act is accomplished, the mates desert the nest and move upstream, perhaps to participate again in reproduction. They die, however, shortly after shedding the last of their germinal products, as is indicated by the many disintegrating carcasses floating downstream.

In the meantime, the fertilized eggs have started development and will soon hatch into tiny, free-swimming larvae. These are delicate transparent creatures that seek cover at once in the nearest mud bank. Here they are destined to live for a long time. The larval lampreys are not parasites like their parents, but are "mud eaters". To fit them for this type of diet, the mouth is provided with an



MATURE LAMPREYS ARE 18 TO 22 INCHES IN LENGTH

They are like an eel in elongated body and scaleless skin, but otherwise differ widely from an eel. They have seven separate gill openings on a side, as visible here, and have the sucking instead of the biting mouth

elaborate set of strainers and is surrounded by a large hood, shaped somewhat like an old-fashioned sun bonnet. The strainers enable the larvae to extract from the liquid mud of their surroundings the fine particles of partially decayed vegetable matter, possibly also microscopic plant and animal organisms, at the same time excluding grains of sand and other coarse particles that would clog up the digestive tract. On this diet they feed and grow until they reach a length of about six inches and an age of probably four or five years. Then the final refinements of mouth apparatus suddenly occur and convert them into parasitic feeders. Then, riding the floods of springtime, they make the journey to the sea, there to begin a new phase of growth on the rich blood of fishes.

What vicissitudes befall the young lampreys after they enter the vast reaches of the ocean must be left to the imagination. Practically nothing is known regarding this period of their existence. They are not encountered again until they have become mature individuals, eighteen to twenty-two inches in length, when they reappear in the coastal waters as parasites of the larger fishes. Certainly several years of life in the ocean must be required to give them this increase in size. Accordingly, we may be warranted in estimating the age of the animals we see in the rivers as somewhere between eight and twelve or more years.

So the life span of the river lamprey is a cycle that begins and ends in reproduction. The unusual features occurring in the cycle find their explanation in the grade of organization and the manner of feeding of the lamprey. The migratory journey, in its turn, must be regarded as a part of the reproductive function, through which the continuance of the species is insured so long as man permits.

The Sacred Quetzal

By EDITH M. LAING

Familiar to collectors of Guatemalan stamps is the beautiful crested quetzal, sacred bird of the Mayas. So venerated is the quetzal, or resplendent trogon, *Pharomacrus mocinno,* which cannot live in captivity, that when the country gained its independence, the new-born republic placed the bird on its coat of arms as a symbol of freedom.

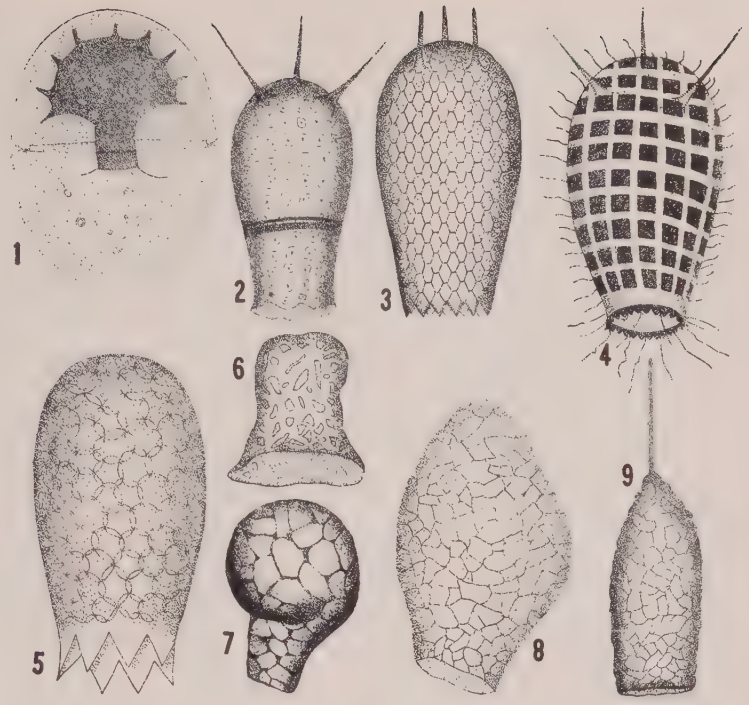
It was named for Quetzalcoatl, lost god of the Mayas and Toltecs, who taught them peace and kindliness, the art of agriculture, and the substitution of grain, fruit, and perfumes as offerings in place of human sacrifices. The return of this revered god is still looked for by the Indians, who today live among the jungle-choked ruins of the ancient Mayan civilization.

The quetzal is noted for its beauty of both form and coloring. In brilliant contrast to its crested head and back of iridescent green are the crimson breast and long black plumes of the wings. But the quetzal's chief characteristic is its graceful tail of bluish-green extending in a ten-inch sweeping curve. These royal tail feathers were prized as ornaments, and were worn only by Mayan chiefs of exalted rank. An old legend says that Quetzalcoatl wore a beard that was manufactured of these sacred plumes.

Beginning on Page 79, and continuing through the entire Rotogravure Section, we present a remarkable picture story of the history of the microscope. Among the many fascinating things revealed by the powers of the microscope, one of the most interesting is represented by the tiny animals and plants described here by Dr. Cunningham of Duke University, North Carolina.

Architects In Miniature

By BERT CUNNINGHAM



Tiny protozoan architects. (1) *Arcella vulgaris,* a resident of nearly all pond waters, is here shown forming a new individual. The upper half is old; the lower, new. The shell is just forming about the protoplasm extruded from the mouth of the old shell of this amoeba-like animal. (2) *Quadrula,* an amoeboid protozoan with transparent chitin in regular rectangular plates. Also often found in pond water. (3) *Euglypha alveolata,* with shells of regular six-sided plates closely fitted together. (4) *Coleps hirtus,* noted for the projection of thread-like bits of protoplasm through the shell that provide locomotion. (5) *Sphenoderia dentata,* with shell of overlapping plates. (6) *Difflugia cratera,* with grains of sand irregularly cemented to the transparent chitin. (7) *Lesquereusia modesta,* similar to *Difflugia,* but with twisted shell. (8) *Difflugia acuminata,* with sand compactly arranged and covering the entire surface. (9) *Tintinnopsis davidoffi,* noted for its long spine. These varied forms may be seen through the microscope.

THE MICROSCOPE reveals a world of plants and animals little suspected by the uninitiated. It consists of thousands of different forms, some simple, some very complex, and some capable of doing remarkable architectural work. Among these are diminutive, one-celled animals called protozoans and equally tiny simple plants called diatoms.

When mention is made of primitive stone masons one recalls at once the "hewers of stone" of ancient Biblical times, or possibly that stage in the early history of man known as the stone age, when mankind first began to fashion instruments from stone. But, here, these stone masons are simple, one-celled animals that antedated man on the earth by millions of years, and which, through the ages, have maintained the habit of building stone houses in which to live. Many living examples of these minute creatures are to be found in ponds and fresh water pools, especially where there is an appreciable quantity of fine sand.

The final "house" of many species resembles in structure the modern stone veneer house. There is a basic structure around which stones are cemented in place. This usually consists of chitin, a substance similar to the shell of the crayfish or lobster, and which forms the exoskeleton of many insects, or of silicon, a substance similar to glass.

How this basic structure is formed can best be shown in a species which does not finally add the veneer. *Arcella,* a protozoan, is a good example. When a new individual is to be formed a part of an old individual flows out of the opening of the old shell and a new shell of chitinous substance is secreted around the extended part. This shell is at first quite clear, but as the new individual ages it becomes darker until the usual brown color is attained. The new shell is nearly a replica of the old shell; only the most minute variations occur. Thus the shape of the creature becomes the basis of classification.

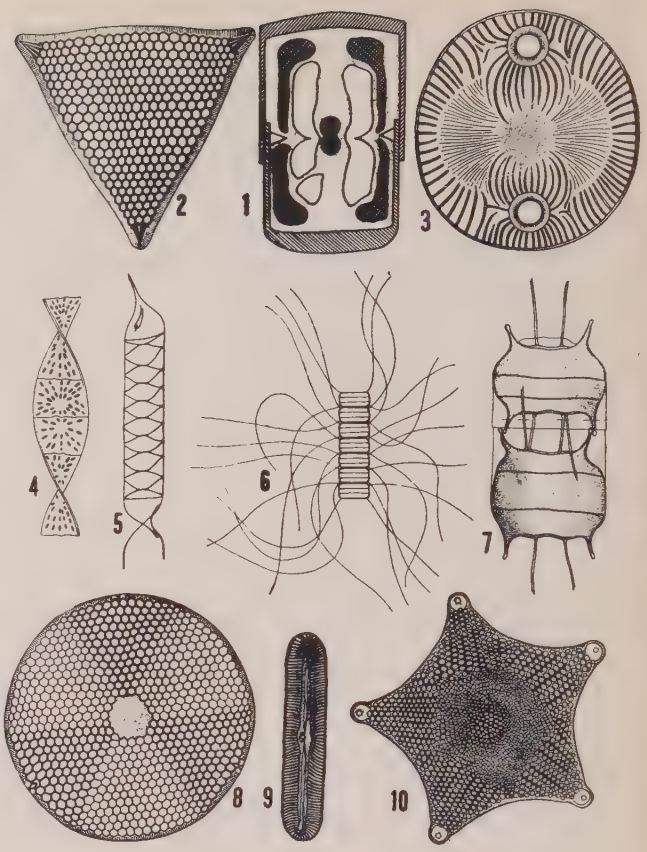
Other animals secrete the shell in the form of plates, which are cemented together in a regular pattern. In some species these are almost ornate.

The basic structure having been laid down in a generally similar manner, sand grains in some species become attached to the chitinous shell and further secretion cements them together. The sand pattern, of course, follows the pattern of the chitin layer.

Various species lay down different patterns, but we always find the same given pattern for a single species. The variety of form is partially shown in the accompanying illustrations. Some are satisfied with a simple dome-like structure; others build helmet-shaped houses; others, more aspiring, put on several cupolas or spines; some build a tall spire.

There are many species of one-celled animals living in the sea that build houses of limestone. When the original house becomes too small a new and larger room is added. This continues until a number of rooms have been formed.

While these shelled protozoa do not occur in any such numbers as diatoms, at times in the history of the earth they have occurred in enormous quantities. Great chalk



Some diatoms. (1) Diatom cut cross-wise to show how the shells fit together and the position of the plant structure. (2) Top view of a triangular diatom, *Biddulphia.* (3) Top view of an oval-shaped diatom, *Auliscus.* (4) Side view of a ribbon-like diatom, *Streptotheca.* Note that the shell is twisted and is practically without markings. (5) Side view of cylindrical-shaped diatom, *Rhizosolenia*, the ends of which are prolonged into spines that fit into grooves in adjoining diatoms, thus permitting the frequent formation of "chains". (6) Side view of a chain of diatoms. *Chaetocerus*, with long projections from the valves. (7) Side view of two *Biddulphia* of a chain, the spines serving for attachment. (8) Top view of a diatom, *Actinoptichus*, the surface of which is wavy. The dark areas represent the upper parts of the wave. (9) Top view of a boat-shaped diatom, *Navicula.* (10) Top view of a star-shaped diatom, *Biddulphia.* The round structure near the end of each ray is a truncated conical projection. Drawings from photographs and slides.

beds, sometimes 1000 feet in thickness, have been formed to a considerable extent by the limestone shells of one-celled animals, which, after the death of the inhabitants, sink to the bottom along with other shells. There they are transformed into chalk.

Each plant architect (diatom) consists of a simple cell encased in a silicious shell. This covering consists of two parts, called valves, one of which fits over the other somewhat as the lid fits on a pill box.

The valves are of various shapes; some are cylindrical, others triangular, still others boat-shaped. Some have spiny projections on the surface while others have several long, horn-like extensions. Others have no extensions whatever. The variety can only be suggested by the accompanying drawings.

The valves are made of silicon, which for our purposes may be considered as a sort of glass. Some of them may be cleaned with strong acids or cleaning solutions and then their full beauty becomes evident. The shell may be finely etched, appearing almost like cut glass. Each species has its own design. Some are quite simple, consisting of transverse grooves; others have intricate patterns.

Diatoms are widely distributed and occur in nearly all bodies of water, from the temporary pool in a cow-track to the ocean. In the small pool they form masses of a brownish hue on the surface of the mud where their activity is evidenced by myriad small bubbles. Great numbers may be picked up by a medicine dropper. In the sea water they are invisible to the unaided eye, but may be collected in quantity by fine nets. Still better, if a quantity of sea water, including some sea-weed, is allowed to rot the shells of the dead diatoms will sink to the bottom. They may then be picked up with a pipette, or the water may be removed, leaving the sediment that contains mostly sand, broken mollusc shells and the diatom shells. In the sea, after the death of the diatoms, the shells sink to the bottom and have formed a substance known commercially as diatomaceous earth. This is used as an insulating material. Tripoli, a form of diatomaceous earth, is used as a high-grade polishing agent.

Diatoms are so small that it would take an inconceivable number to make a volume of one cubic inch. To make a usable quantity of diatomaceous earth must have required both a long period of time and a tremendous number of living individuals, rapidly reproducing, with a high death rate. The geologist concedes the seas to be hundreds of millions of years old, while the biologists who have studied the problem have found enormous numbers of diatoms in sea water; some times a million in a quart of water.

The diatoms, in common with most plants, manufacture food from carbon dioxide and water. Part of this is used for food by the cell itself, and part is stored in the form of oil globules. Since they, in turn, are eaten by the animals of the sea they form an important food-source. For this reason they have been called the "pasture" of the seas.

There are great deposits of shells, more than a mile deep, in the western United States, and it is thought, by some at least, that some of the oil of commerce originated from the oil drops in the diatoms, dead in ages past.

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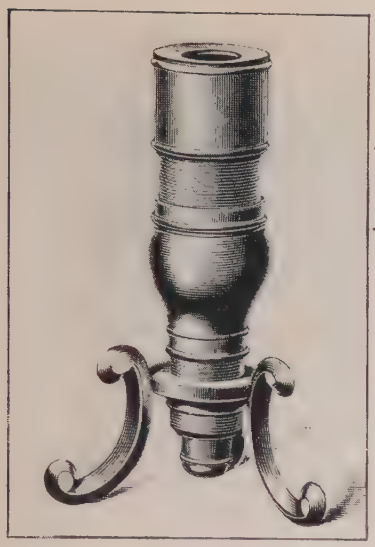
CONFESSION

By OSCAR OSTLUND

The pride of trophies on the wall
Is lost to me;
My claim to hunting fame
Has been erased.

For I've been chased
Two times, by fearless game,
And it was small—
A pheasant and a skunk, respectively.

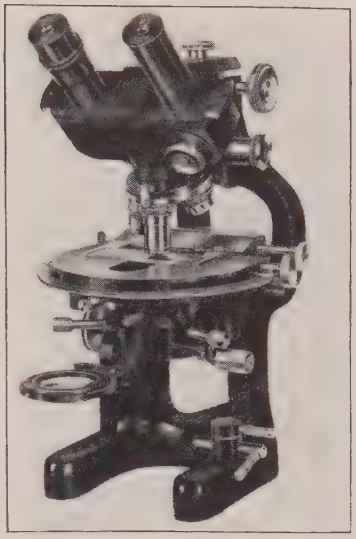


The Microscope

A Pictorial History

By JULIAN D. CORRINGTON

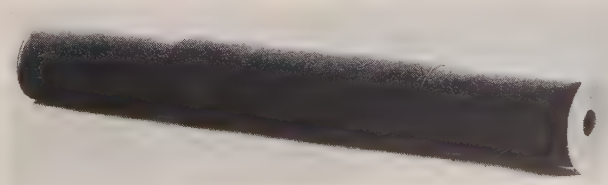
In this article, which is continued in the rotogravure section, Dr. Corrington, editor of our "Under the Microscope" department and Professor of Biology at Washington College, presents a valuable and interesting pictorial history of the microscope, the instrument that has made possible so much progress in science and medicine.



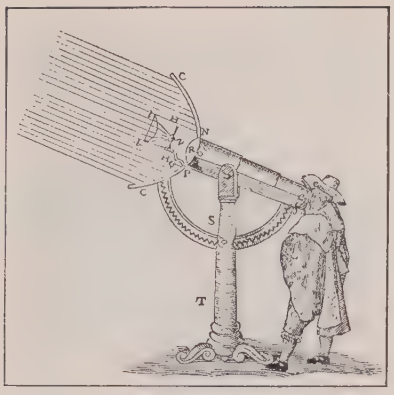
NO positive evidence has been found that the ancients used or knew about lenses, such scattered references as exist being considered unsatisfactory. Sir John Layard discovered a quartz crystal in ruins of the Palace of Nimrod at Nineveh, dating from around 710 B.C., and this object, now in the British Museum, was for a while hailed as an ancient Assyrian lens. Recent and more expert opinion holds that it was a breast-plate ornament. Spectacles came into use in the early Thirteenth Century, but just when this principle of curved glass surfaces was applied to the making of simple lenses for higher magnification of objects is not known. Roger Bacon (1214-1294) used simple lenses, but no further advance seems to have been made for three hundred years.

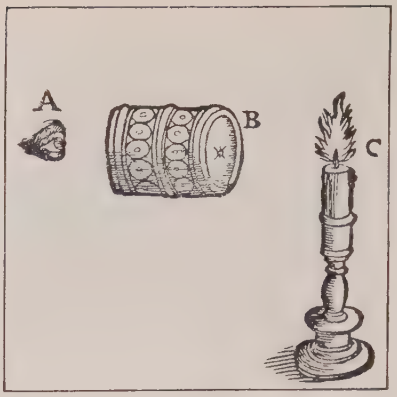
At the top of the page we see the primitive Galilean type of microscope, probably made by Campani about 1697, and a modern Bausch & Lomb instrument. At the left is a picture of Zacharias Jansen, spectacle-maker of Holland, who, in the majority opinion, was the first to make microscopes. At the right is the quartz crystal found in the ruins of Nineveh, dating from 710, B.C., for a while thought to be an ancient Assyrian lens. Recent and expert opinion now holds this to be a breast-plate ornament. Below is a microscope attributed to Jansen. Photographs courtesy Henry Holt, Carl Zeiss and Spencer Lens Company.

When and by whom the compound microscope was first invented is likewise a controversial subject. The majority opinion inclines to Zacharias Jansen, spectacle-maker of Middleburg, Holland, between 1591 and 1608. He later constructed both microscopes, fly glasses and telescopes (spy glasses), using for each the sliding-tube principle. Galileo, around 1608-1610, made both instruments also and is considered the "effective inventor" of them since he made them the common property of scientific men. The earliest printed illustrations of microscopes appear in the *Dioptrique* of Descartes (1637), including that reproduced here, showing his conception of the "ideal microscope." As far as is known, this cumbersome affair was never manufactured. Descartes also described the first simple microscopes—lenses mounted on stands.



During the next forty years simple microscopes became the popular scientific toys of the day. Since they were used chiefly in observing insects they were termed flea glasses, *vitrea pulicaria,* or fly glasses, *vitrea muscaria,* or, having minute glass spheres as lenses, *microscopia globularia.* The commonest types were about the size of the thumb, merely tubes with lens at the viewing end. Many were ornamented.

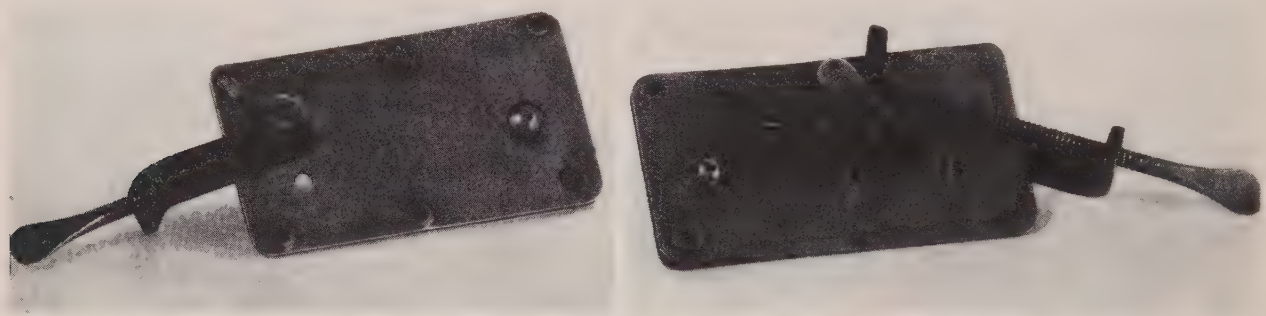




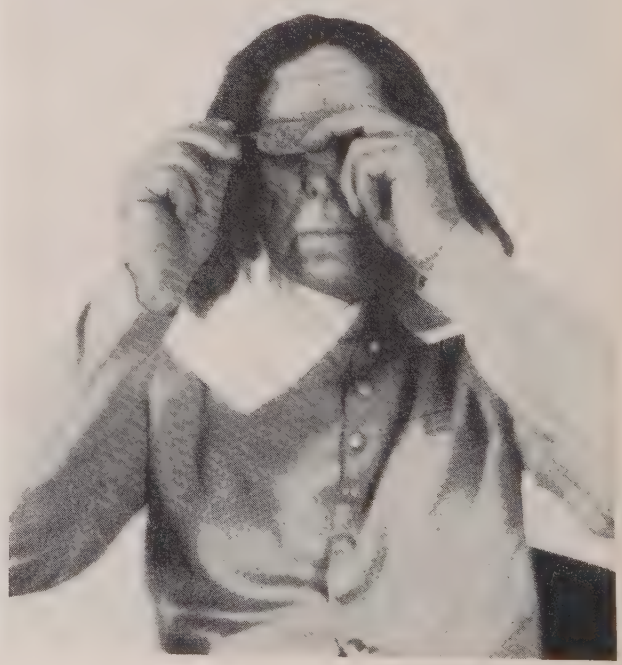
Above, left, is Descartes' drawing of the "ideal" microscope. Center is a flea glass from Zahm, 1685, and at the right are early microscopes pictured in Schott's *Magia optica,* 1671. These were small instruments, the artist sketching in entire human figures instead of the conventional eyes at the viewing ends. Illustrations courtesy of Henry Holt and Company, from Locy, *The Growth of Biology.*

Climax of development of the simple microscope came at the hands of Antoni van Leeuwenhoek of Delft, Holland (1632-1723), greatest of all amateur microscopists. He early learned to grind exceedingly minute double convex lenses with diamond dust, and during his long life made 419, of which 247 were mounted as simple microscopes in various styles of frames, often with adjustable object holders, as in the one surviving instrument, here illustrated. Magnifications ranged between 40 and 133 diameters, with 160 as the highest attained.

No one else has ever made such remarkable instruments, and Leeuwenhoek demonstrated circulation of the blood, discovered bacteria and protozoa, and made a great many other valuable scientific contributions to knowledge.

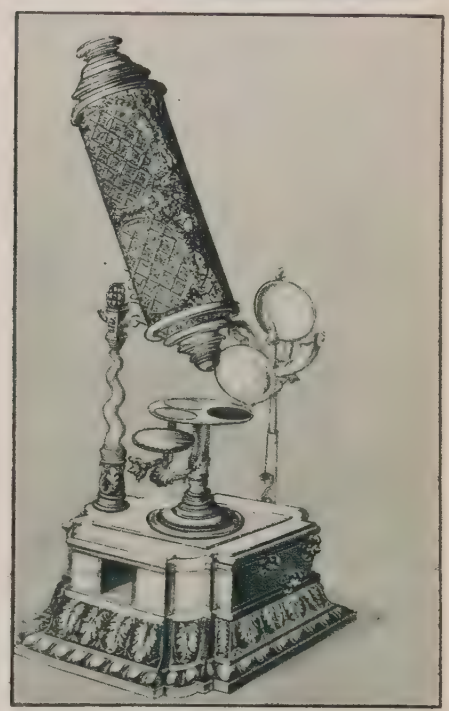


Above are front and rear views of a known Leeuwenhoek microscope, here shown by courtesy of Carl Zeiss. Below, at the left, is a portrait of Leeuwenhoek, the greatest of all amateur microscopists, courtesy of the Spencer Lens Company. At the right is a hypothetical Hollander, showing the manner in which this early microscope was held and used. Courtesy Bausch and Lomb.

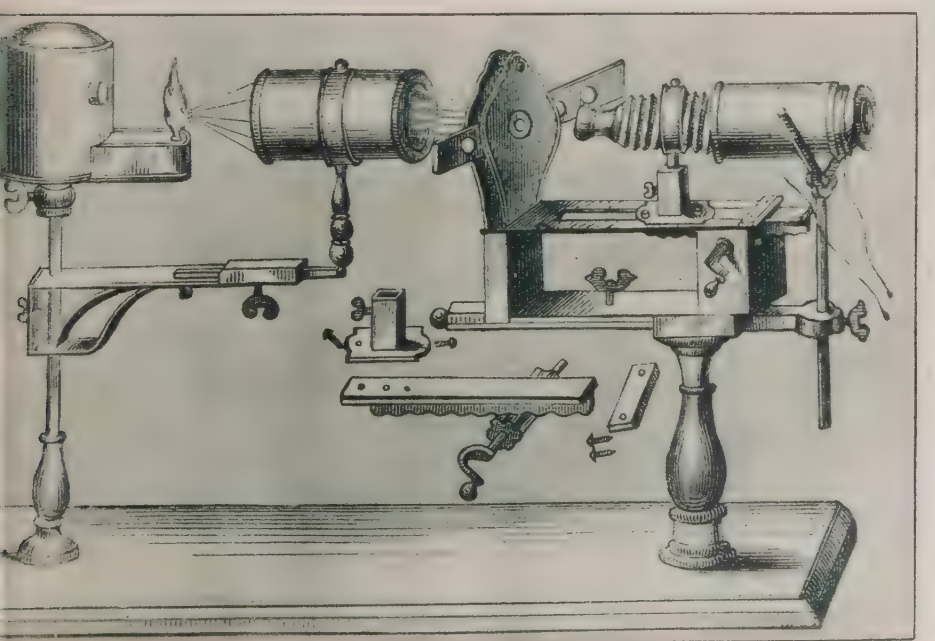


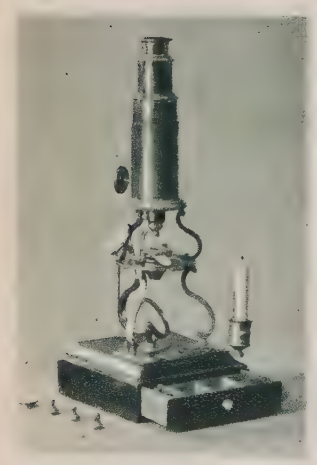
While Leeuwenhoek was perfecting the simple microscope, other makers of this period placed their faith in the compound instrument. This type uses two lenses or combination of lenses; the one nearest the eye of the observer is the eyepiece or ocular, while that nearest the object observed is the objective.

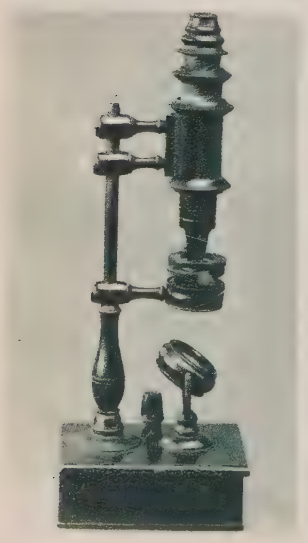
Robert Hooke of England made many discoveries and gave the name cell to the units of plant and animal construction. His microscope shows interesting ornamentation, tilting body, movable stage, and a condensing lens to bring light rays to a focus upon the object. Hertel placed a mirror above the stage for reflected light and another below for transmitted light. Bonnani experimented with a horizontal microscope which had many modern features, including interchangeable objectives, coarse and fine adjustments, condenser, sliding object carrier, and permanent alignment of light source and microscope.

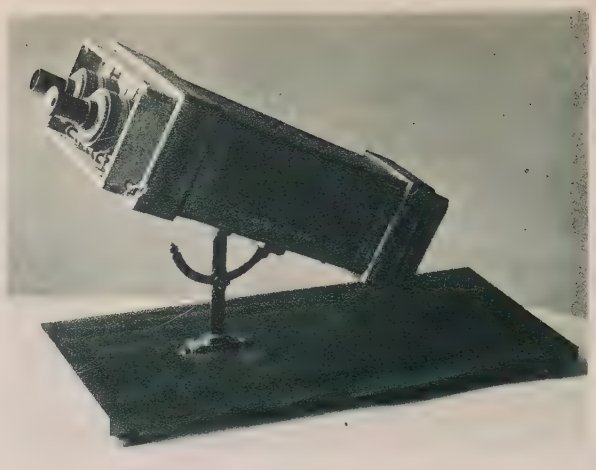


Early microscopes of the late seventeenth and early eighteenth centuries are found on this page. Upper left, is a drawing of the microscope of Robert Hooke, date about 1660. Courtesy E. Leitz. Next to it is a more modern-looking instrument of about 1708 made by John Marshall of London. Courtesy Carl Zeiss. The curious affair next to it is Grindelin's microscope, showing, also, the lens arrangement. Courtesy Spencer Lens Company. The fancy one at the right is Hertel's instrument, date, 1691. Courtesy E. Leitz. Directly below is Bonnani's horizontal microscope of 1691. Courtesy Spencer Lens Company. In the lower right hand corner is a pocket microscope by Campani of Rome, bearing the date 1697. Courtesy Carl Zeiss.





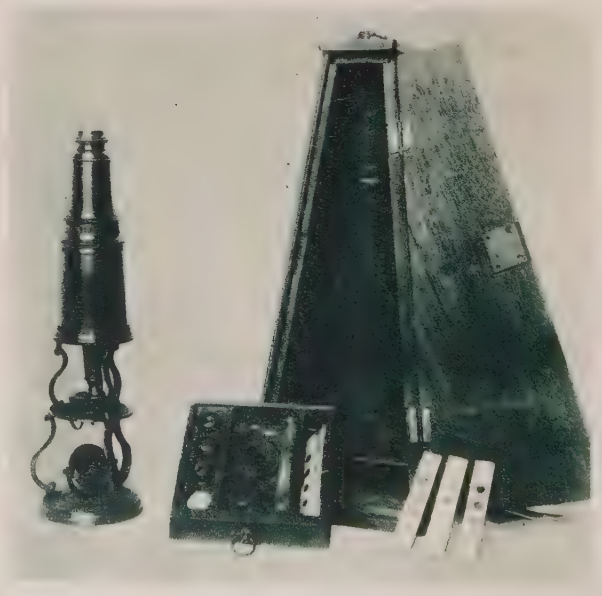


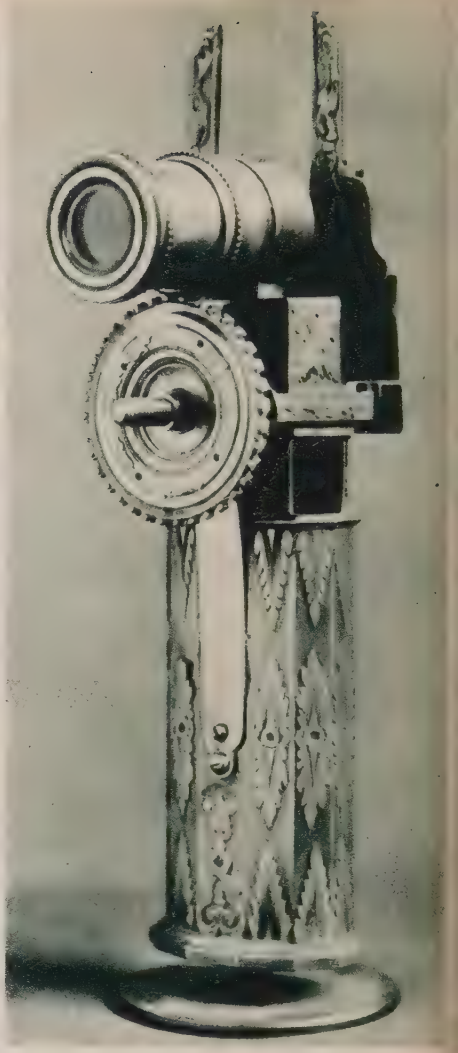


In 1646 Fontana of Naples improved the Jansen microscope by putting in a positive eyepiece in place of the negative one of Jansen. He thus obtained a magnification of over 300X, sounding the knell of simple microscopes. Christian Huygens, Dutch mathematican and physicist, in 1660 made an improved negative eyepiece of two lenses, and his design is the familiar Huygenian ocular in commonest use today.

Many and varied were the designs of early compound microscopes, with much attention to mounting and ornamentation. Some of these experimental styles have long since been abandoned while traces of others survive. Even the binocular microscope, which one thinks of as essentially modern, was produced, the Cherubin d'Orleans designing one in the last quarter of the seventeenth century, our illustration showing an early eighteenth century model.

Joblot made a microscope with a horizontal eyepiece, while artisans of Nuremberg turned out some beautiful wooden stands.





Reading from top to bottom of the strip at the left we see the front view of a patent by Mitsdorffer of Berlin in 1749. Then a wooden microscope made in Nuremberg about 1750. Next, an early eighteenth century instrument of Huntley, London, candle and all. Finally a wooden microscope after a Cuff design. All courtesy Zeiss. At the top of the page, center, is a binocular affair after Cherubin d'Orleans, an early eighteenth century model. Courtesy Zeiss. The fancy one, top right, is Joblot's invention with horizontal eyepiece. Courtesy Bausch and Lomb. Center, above, is a Doullon model with case and accessories. Courtesy Bausch and Lomb. Next to it is a cabinet microscope of 1740. Courtesy E. Leitz.

THE

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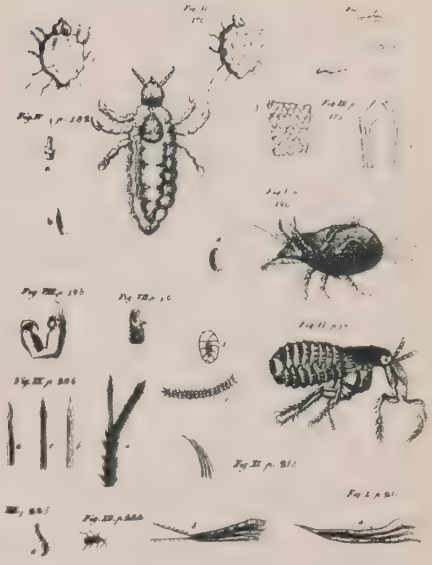
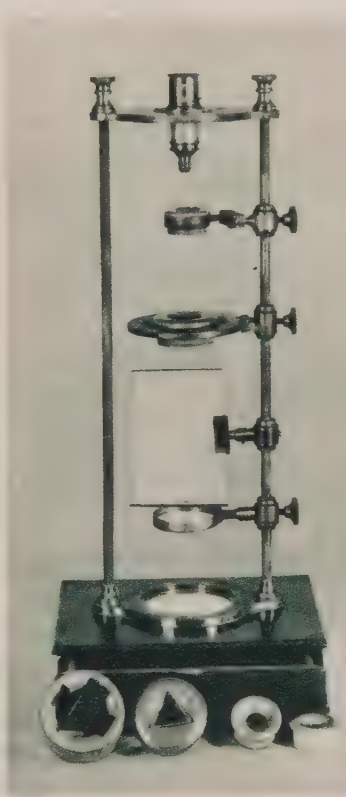
Rerum Natura nuſquam magis quàm in Minimis tota eſt.
PLIN. Hiſt. Nat. Lib. XI. c. 2.

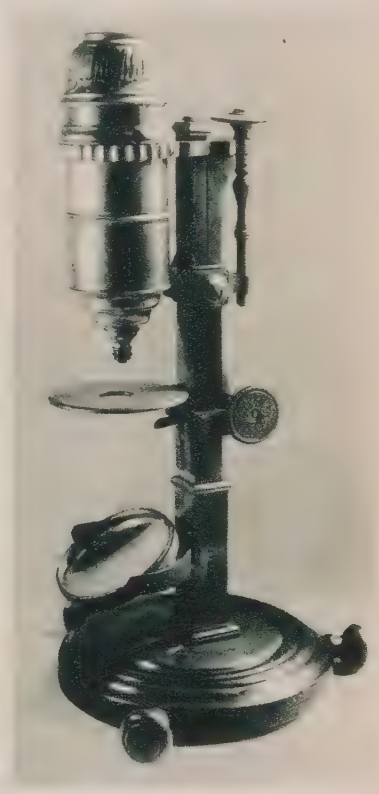
LONDON:

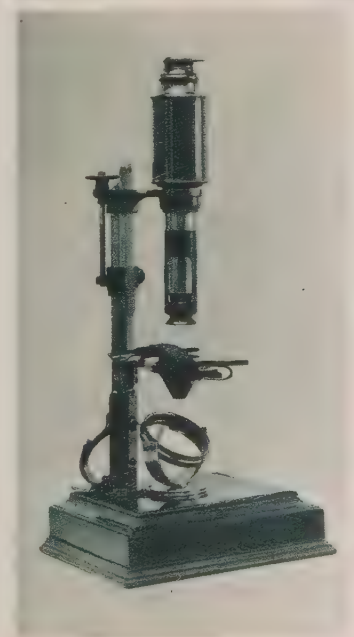
Printed for R. DODSLEY, at *Tully's Head* in *Pall-Mall*; and ſold by M. COOPER, in *Pater-noſter-Row*, and J. CUFF, Optician, in *Fleetſtreet*. 1743.

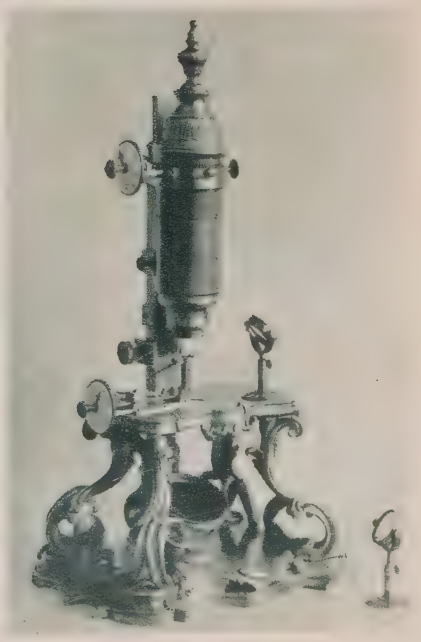
Here we see the title page of Baker's work and a page of sketches from the same volume showing objects seen through the microscope. Courtesy Spencer Lens Company. Directly below, right, is the instrument owned in 1758 by the famous French naturalist Buffon, and, next to it, a curious affair with numerous adjustable object holders and condensing lenses. Courtesy Bausch and Lomb. Bottom, left, is a microscope by Sterrop, London, after Cuff, 1750, and an instrument made for the Duke of Chaulnes about the same time. Courtesy Zeiss.







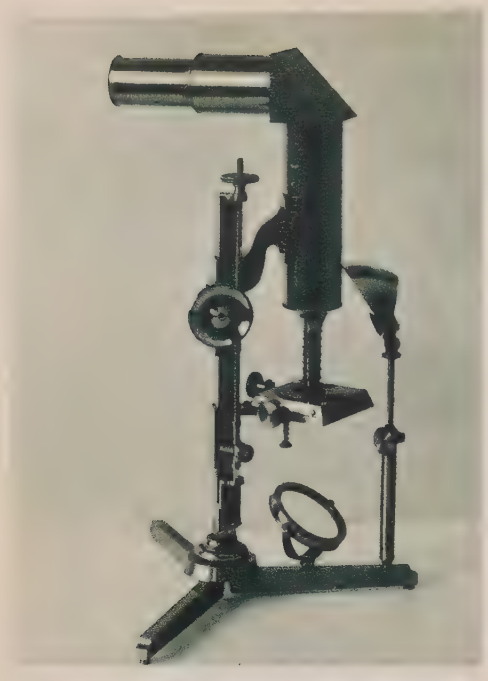


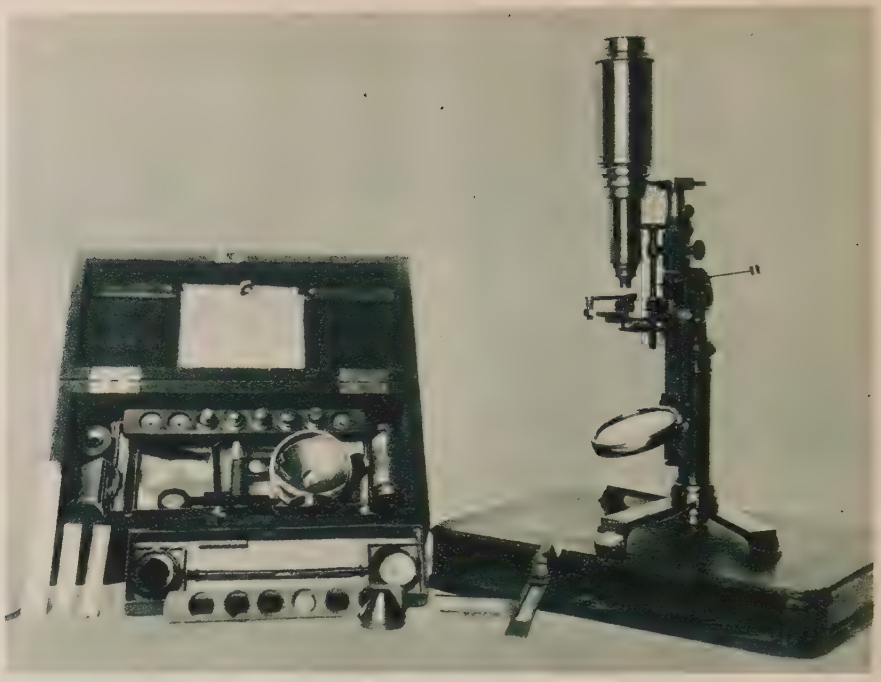


On this page appear two interesting illustrations from a work by Henry Baker.

Meanwhile improvements in the optical system were going forward. Hall of England, in 1733, made probably the first achromatic telescope objective. By combining lenses of differing refractive indices he eliminated the fringe of color known as chromatic aberration, which had heretofore made the image blurred and defective for the higher powers. Another Englishman, John Dolland, in 1759, achieved the same result even more perfectly by combining lenses of two kinds—crown and flint. Not until 1812, however, did anyone apply this principle to the microscope, Amici of Modena making objectives corrected for both chromatic and spherical aberration. J. J. Lister, the father of Lord Lister, Selligues and Chevalier, both of Paris, and others, contributed to this problem, so that by 1837 splendid microscopes were obtainable, combining high magnification with good resolution.

The latter half of the eighteenth century saw the climax in development of the rococo in microscope stand design, and beautiful indeed were many of these elaborate models. Thereafter utility gained the upper hand over ornamentation. Buffon, whose microscope is shown, was a famous French naturalist of the Court of Louis XV and later Louis XVI.

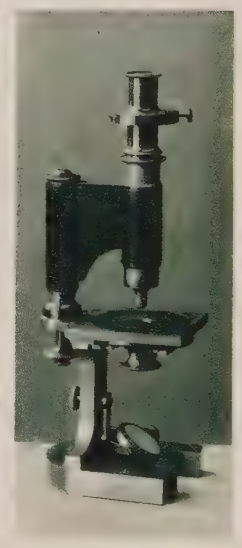


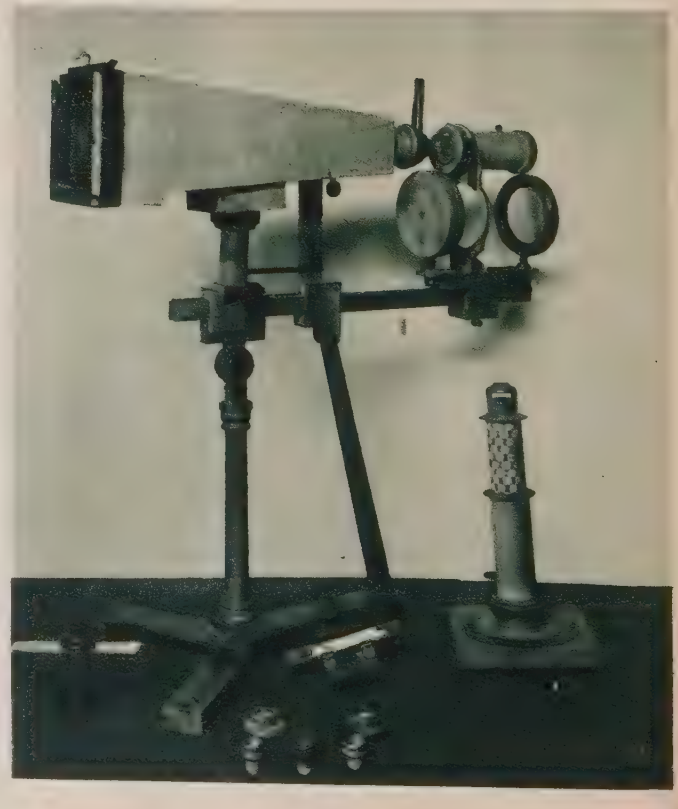


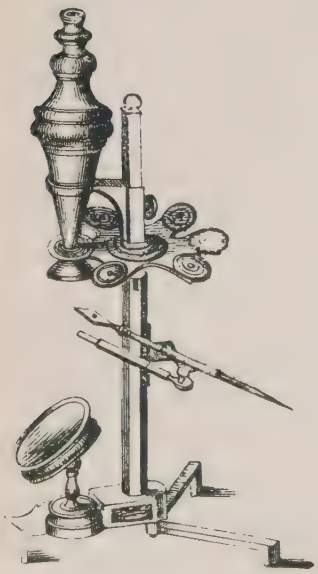
The nineteenth century ushered in an era of marked improvements and a practical type of stand construction so that microscopes began to take on a modern appearance.

That made for John Dalton, famous father of the atomic theory, cornerstone of chemistry, may be taken as typical. All parts were of brass and both coarse and fine adjustments were included, the latter at the top of the pillar and spring-actuated. The mirror had plane and concave surfaces and there was a detachable mechanical stage, polarizing equipment and still other accessory devices.

Also shown on this page are early eighteenth century attempts to produce two designs in constant use today, a microprojector and an instrument with some means of changing objectives without having to unscrew each by hand.







Top, left, is an achromatic microscope by Ploessl, Vienna, 1840, with horizontal eyepiece. Courtesy Zeiss. Next to it a touch of the modern in an early nineteenth century machine by Charles. Courtesy Bausch and Lomb. Grouped are a drum microscope after Oberhauser, 1814; Oberhauser instrument with horseshoe base, 1846 (Courtesy Zeiss); and Dancer microscope of John Dalton, about 1841. Courtesy J. F. Stirling. At left, Adams' device for changing objectives (Courtesy Zeiss); and, right, Adams' eighteenth century projection microscope. Courtesy Spencer Lens Company.

The Sky at Night

The third in a series of educational inserts

By E. LAURENCE PALMER

So much recommended star study deals either with profound mathematics or imaginary mythology that material intermediate between these extremes should be helpful.

The North Star, to the mythologist, is the end of the long tail of the little bear, Ursa Minor, but to those using the following pages it will be three stars, so far away that they appear as one; so far, in fact, that it takes light about 250 years to come from them to the earth. The North Star is a thousand times as brilliant as our sun, with magnitudes of 2.1 and 9 and with periods of 3.96 days and 11.9 years. And what, some may ask, do we mean by periods, magnitudes and light years? While it may take some imagination to understand some of these things, they are, no doubt, more easily understood than many of the mathematical formulae of the professional astronomer. We have no desire to discourage star study in all its complexity, but it is easier to remember a distance of 250 light years, for example, than a number with a regiment of zeros.

The term "light-year" of course refers to the distance light travels in a year. Light travels about 186,000 miles a second, or about 6 million million miles a year, so it is plain that if we deal with light years in such figures mathematical short cuts are helpful.

In star study we soon run into the term magnitude and one may naturally assume that this refers to size, when, as a matter of fact, it means brilliance. The beginner in astronomy must not assume that a star with a magnitude of 6 is brighter than one with a magnitude of 2, 3, or 4. In astronomy the most brilliant stars are given a magnitude of 1, and are spoken of as "first magnitude" stars. There are also stars brighter than magnitude 1, as Sirius, minus 1.6, and Canopus, minus 0.9. Less brilliant stars are given, in order of less brilliance, numerical values such as 2, 3 and 4. Stars whose magnitudes are indicated as of 6, or more, cannot be seen with the naked eye, even under the best conditions, which brings us back to the North Star, one of the stars that has a magnitude of 9, and cannot, of course, be seen with the naked eye.

We will meet such terms as double stars and triple stars. These are simple since they refer to the actual number of stars in what appears to the eye to be only one. At a sufficient distance an automobile's head-lights appear as one light, becoming two or more as the car approaches. So it is with our stars, and many who start to study stars are surprised that there are so many that are double, triple or multiple, but are near enough together to appear as one.

The term variable, of course, refers to differences in brilliance at different times, and stars are variable for a variety of reasons. Study of such stars is a special phase of the study of the heavens, and to attempt to discuss this subject in a brief paragraph would be only to confuse the reader. It is, however, something worthy of special investigation, and a splendid aid to this is *The Nature of Variable Stars* by Paul W. Merrill, a popularly-written discussion.

The next most commonly used term in the charts that follow is that of "period". This refers to the length of time required for one star to complete a revolution around another.

Use of the Remainder of This Section

The remainder of this section may be used with or without the help of a planisphere. A planisphere may be purchased separately, or may be made from the diagrams on Page 99, following the directions given.

The first two charts provide maps of the heavens as they may be seen at any time of the year over most of the United States. They include the Circumpolar Constellations. The other charts are continuations of portions of the sky as indicated on the charts of circumpolar constellations. Some of the stars in these charts may easily be seen on summer evenings, and others on winter evenings. The nature of the stars numbered in these and the other charts is explained in the text opposite each chart.

If one wishes to locate a star, or constellation, whose name is known but which is not named on the planisphere map the following star and constellation directory may be useful. In it the Roman numerals are used to indicate the chart in which the star or constellation is considered, and the Arabic number to indicate the number assigned to the individual star. Thus IX, 15 refers to star number 15 in chart IX.

Directory

Albireo, IX, 15
Alcaid, VII, 1
Alcyone, IV, 19
Aldebaran, IV, 21
Algenib, III, 13
Alhena, V, 14
Alpheratz, III, 12
Altair, IX, 29
Andromeda, III, X
Antares, VIII, 35
Aquarius, IX
Aquila, IX
Archer, IX
Arcturus, VII, 18
Aries, III
Auriga, I, IV
Beehive, V, 8
Bellatrix, IV, 24
Betelgeuse, IV, 25
Big Dipper, See Ursa Major, I, IV
Bootes, II, VII, VIII
Bull, IV
Camelopardus, I, II
Cancer, VI
Canis Major, V
Canis Minor, V
Canes Venatici, VII
Capella, IV, 1
Capricornus, IX, X
Cassiopeia, I, II, III
Castor, V, 1
Cepheus, I, II
Cetus, III
Circlet, V, 14
Coma Berenices, VIII
Cor Caroli, VII, 4

(Continued on page 92)

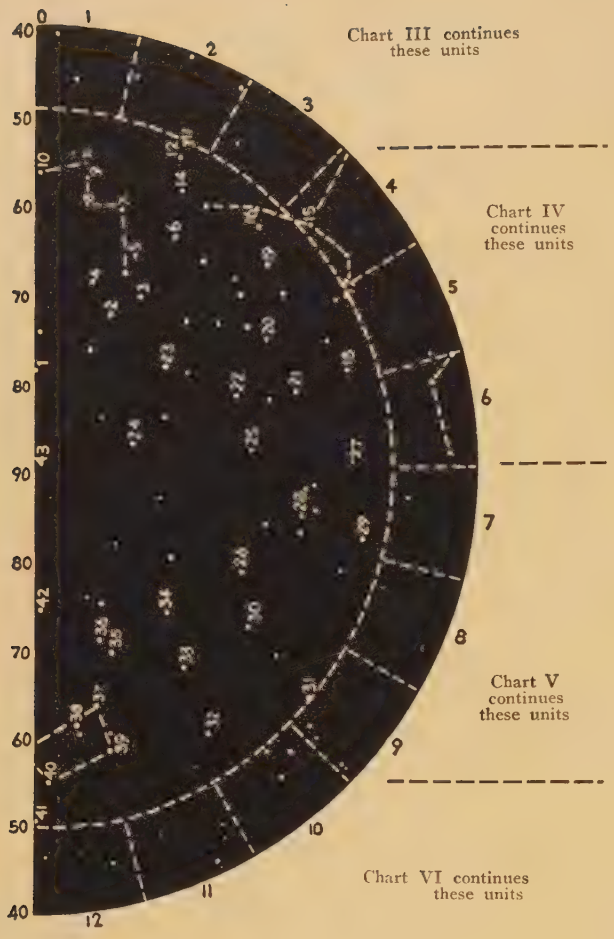


Chart III continues these units
Chart IV continues these units
Chart V continues these units
Chart VI continues these units

Chart VII continues these units
Chart VIII continues these units
Chart IX continues these units
Chart X continues these units

CHART I

POLAR CONSTELLATION CHART

Cepheus. Star 1, period 166.2 years.

Cassiopeia. Star 2, double, magnitudes, 4.7 and 7.2; period, 52.95 years; Star 3, triple, magnitudes, 4.2, 7.1, 8.1; Star 4, triple, magnitudes, 4.4, 8.9, 9.5; Star 5, magnitude, 3.4; Star 6, gold-green, double, magnitudes, 6.1, 6.6; Star 7, magnitude, 2.8; Star 8, magnitude, 2.2; Star 9, gold-red, double, magnitudes, 3.6, 7.9; period, 507.6 years; Star 10, magnitude, 2.4; distance, 5.7 light years; Star 11, Shedir, variable, magnitudes, 3.6 to 7.9; distance, 47 light years.

Perseus. Star 12, double spiral nebula joined with a ring; Star 13, double; periods 126.5 days, 63.2 days; Star 14, double, variable, magnitudes, 7.5 to 11 and 8; period, 320 days; Star 15, Mirfak, magnitude, 1.9; period, 4.09 days; Star 16, magnitude, 3.1; Star 17, magnitude, 4.5; period, 1.5 days.

Camelopardus, the Giraffe. Star 18, double, magnitudes, 4.4, 11.3; period, 3.8 days; Star 19, double, magnitudes, 4.8, 9.2; Star 20, nebula; Star 21, magnitude, 4.7; Star 22, magnitude, 4.3; period, 7.9 days; Star 23, magnitude, 4.7; Star 24, double, magnitudes, 4.5, 8; Star 25, triple, magnitudes, 6.7, 7.9, 10.9; Star 26, triple, magnitudes, 6.2, 8, 9.2.

Auriga. Star 27, magnitude, 2.1.

Lynx. Star 28, triple, magnitudes, 5.2, 6.1, 7.4; Star 29, variable, magnitudes, 7 to 13.8; variation period, 379.2 days.

Ursa Major, the Great Bear. Star 30, magnitude, 3.5; Star 31, variable, magnitudes, 8.4 to over 13; period 247 days; Star 32, double, magnitudes, 5, 5.6; period, 99.7 years; Star 33, double, magnitudes, 3.8, 9; Star 34, double, magnitudes, 5, 8; Star 35, magnitude, 4.9; period, 11.58 days; Star 36, variable, magnitudes, 7 to 13; variation period, 302 days; Star 37, Dubhe, magnitude, 2; distance, 70 light years; Star 38, double, magnitudes, 5.8, 7.1; period, 71.9 years; Star 39, magnitude, 2.4; period, .31 days; distance, 60 light years; Star 40, magnitude, 2.5; Star 41, spiral nebula.

Draco, the Dragon. Star 42, double, magnitudes, 7, 8.3; period, 42 years.

Ursa Minor, the Small Bear. The polestar, Polaris, 43. This is really a triple star. The major group has a magnitude of 2.1, is yellow, has 190 light years distance and is a thousand times as brilliant as our sun. Two of the units turn around each other in a period of 3.96 days, and these in turn move about the third in a period of 11.9 years. Another unit has a magnitude of 9.

CHART II

Camelopardus, the Giraffe. Star 1, variable, magnitudes, 7.9 to 13.7; variation period, 269.5 days; Star 2, double, magnitudes, 5, 6.

Ursa Minor, the Small Bear. Star 3, Kochab, the polestar in A. D. 140; magnitude, 2.2; distance, 230 light years. Stars 4, 5, 6, parts of the "little dipper"; Star 7, magnitude, 4.4; period, 39.5 days; Star 8, double, magnitudes, 7, 8; variation period, 115 years; Stars 9 and 10 variable; magnitudes over 7.

Draco, the Dragon. Star 11, magnitude, 3.9; Star 12, Thuban, magnitude, 3.64; period, 51.38 days; the polestar when pyramids were built more than five thousand years ago; Star 13, magnitude, 3.5; Star 14, triple, magnitudes, 7.5, 7.7, 9; Star 15, double, magnitudes, 2.9, 8.1; Star 16, magnitude, 3.2; Star 17, magnitude, 4.87; period 5.28 days (the pole of the ecliptic is indicated by a cross almost south of this star); Star 18, double, magnitudes, 4.8, 6.5; Star 19, magnitude, 3.6; period, 281.8 days; Star 20, period, 4.12 days; Star 21, double, magnitudes, 4, 7.6; Star 22, triple, magnitudes, 4.7, 7.7, 7; Star 23, variable, magnitudes, 7.5 to 12.2; variation period, 426 days; Star 24, double, magnitudes, 4.6, 4.6; Star 25, magnitude, 2.4, distance, 74 light years; Star 26, double, magnitudes, 5, 5.1; Star 27, double, magnitudes, 5, 6.

Bootes, the Herdsman. Star 28, double, magnitudes, 4, 12.

Ursa Major, the Great Bear. Star 29, Mizar, the first double discovered, magnitudes, 2.1, 4.2; period, 20.23 days; distance, 80 light years; Star 30, magnitude, 1.68; 56 light years away; period, 4.15 years.

Cygnus, the Swan. Star 31, double, magnitudes, 5, 9; Star 32, double, magnitudes, 6.8, 7.4; Star 33, variable, magnitudes, 15 to 1.9 in 10 days; Star 34, triple, magnitudes, 7, 9, 10.1.

Cepheus. Star 35, triple, magnitudes, 6.3, 7.9, 8; Star 36, magnitude, 2.6; distance, 36 light years; Star 37, double, magnitudes, 4.7, 6.5; Star 38, variable, magnitudes, 3.6 to 4.3; variation period, 5 days, 8 hours, 48 minutes; Star 39, double, magnitudes, 3, 7; period, .19 days; Star 40, variable, magnitudes, 7.9 to 13; variation period, 486 days; Star 41, double, magnitudes, 9.3, 10.8; period, 54.9 years; distance, 12.5 light years.

Cassiopeia. Star 42, triple, magnitudes, 7, 8.5, 9; Star 43, quadruple, magnitudes, 4.8, 10, 7.4, 8.9; period, 6 days; Star 44, variable, magnitudes, 5.3 to 12.7; variation period, 431.6 days.

Chart III

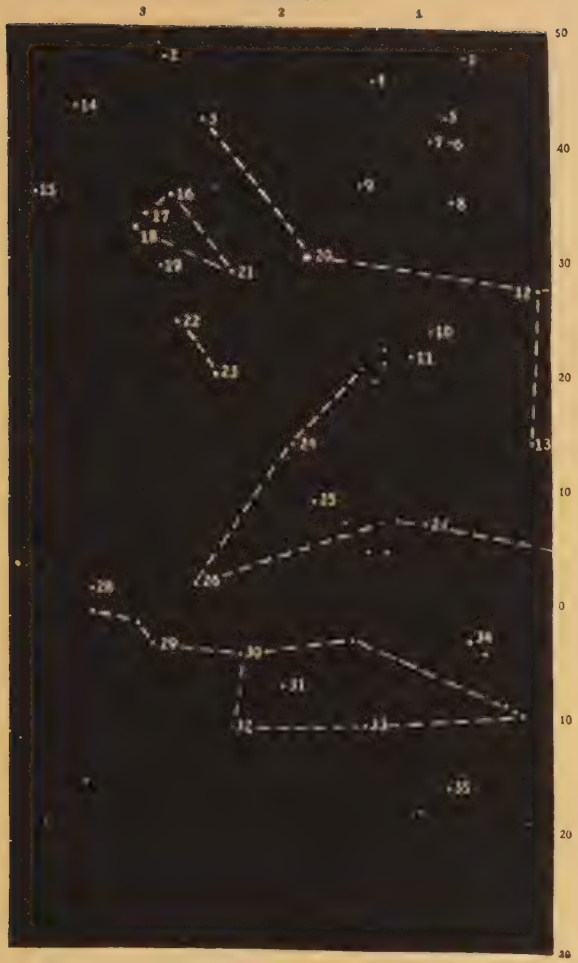


CHART III

Constellation **Cassiopeia,** Star 1, magnitude 5.02, period 1.7 days. Stars 2 to 12 are in the constellation **Andromeda.** Star 2, double, magnitudes, 6.4, 7.3; period, 204.7 years. Star 3, double, magnitudes, 2.3, 5.4, is a cerulean blue and gold star with a period of 55 years. Star 4, double, magnitudes, 4.9, 6.5, is made of two blazing suns. Star 5 is an oval pearl-white nebula. Star 6 is a great spiral nebula and the nearest of the spiral nebulae to the earth. It is 900,000 light years distant and 50,000 light years in diameter. On a reasonable assumption, it takes about 17,000,000 years for it to complete a single revolution and it produces one billion and a half times the light produced by our sun. It has a mass of the order of 1,000,000,000 times the mass of our sun. Star 7 has a magnitude of 4.4 and a period of 4.28 days. Star 8, double, magnitudes, 6, 9, has a period of 143.7 days; Star 9, magnitude, 2.4; Star 10, magnitude, 4.3; period, 17.76 days; Star 11, double, magnitudes, 6.1, 6.7; period, 109.07 years. Star 12, Alpheratz, has a magnitude of 2.2 and a period of 96.67 days. Its temperature is about 11,000° C.

Star 13, Algenib, in the constellation, **Pegasus,** has a magnitude of 2.9. One side of the Great Square of Pegasus is limited by these last two stars.

Perseus, Star 14, a beautiful cluster 20,000 light years distant, Star 15, a double, magnitudes, 5.6, 6.7; period, 33.3 years.

The Constellation **Triangulurn** includes a number of interesting stars. Stars 16, 17, and 18 are almost in line and have magnitudes of 3.1, 5, and 4 respectively. Star 19, double, magnitudes, 5.6, 6.4, is sapphire-gold. Star 20 is a nebula 900,000 light years away with a period of 160,000 years. Star 21 has a magnitude of 3.5 and a period of 1.7 days.

In the constellation **Aries,** Star 22, Hamal, the Shepherd's Star, magnitude of 2.2; and Star 23, magnitude, 2.7, period, 107 days.

Stars 24, 25, 26, and 27 are in **Pisces.**

The constellation **Cetus, the Whale,** includes at least eight interesting stars. Star 28 is a double, magnitudes, 3, 6.8. Star 29 is Mira, whose magnitude varies from 1.7 to 9.6. It has a variation period of 332 days and is 165 light years distant. It is a globe of gas 250 million miles in diameter and about 300 times the size of our sun. Star 30 is a dark nebula, and Star 31, a nebula, is unique because it is moving through space at the velocity of 1240 miles a second. Star 32 is a dark nebula. Star 33 has a magnitude of 4. Star 34 is a double, magnitudes, 5.2, 6.4; period, 6.88 years. Star 35 has a magnitude of 2.2.

Chart IV

CHART IV

The star Capella, Star 1, is the most conspicuous one in **Auriga.** Its magnitude is .21; period, 104 days. It is 150 times as bright as the sun, has a surface temperature of 10,400° F., and is 47 light years distant. Star 2, magnitude, 2.7; period, 3.96 days; mass, 17 times that of the sun; Star 3, magnitude, 5.3; period, 28.2 days. Star 4 is a mass of 20,000 stars. Star 5, triple. Star 6 is a large sun, magnitude, 2.9.

Perseus, Algol, Star 7, the Ghoul, or Demon-Star; magnitude, 2.2 to 3.2; period, 2.87 days; mass, ⅔ that of the sun; 160 times as bright as the sun. Stars 8, 9, and 10, periods of 284 days, 6.9 days, and 4.4 days.

Taurus, the Bull, is always interesting. **The Pleiades** and the star Aldebaran are the most important. Star 11, magnitude, 4.5; period, 5.9 days; Star 12, magnitude, 1.8; Star 13, magnitude, 5; period, 27.8 days; Star 14, double, magnitudes, 5.8, 6.6; blue-white; Star 15, "crab nebula"; Star 16, magnitude, 3; period, 138 days; Star 17, a nebular cluster; Star 18, double, magnitudes, 4.3, 7.2; period, 15 days. Alcyone, Star 19, a star in the Pleiades, has a magnitude of 3 and is millions of miles in diameter. The cluster is made of over 500 giant suns and is 30 light years in diameter. The volume of each of the 5 brightest stars of the cluster is at least 800 times that of the sun. The cluster is 325 light years distant, or 2½ times more remote than **the Hyades.** Star 20, magnitude, 5.6; period, 8.4 days. Aldebaran, Star 21, the "eye" of the Bull, the Hyades, magnitude, 1.1, has a diameter of 40 million miles.

Orion, the Hunter, Stars 22 and 23, periods, 56 years and 16.61 years; Bellatrix, Star 24, the Female Warrior, magnitude, 1.7; Betelgeuse, Star 25, magnitude, .9; period, 6 years; surface temperature, 4700° F. Star 25 is 1200 times as bright as the sun. Its volume is 27 million times and its diameter 300 times that of the sun. It is 192 light years distant and has an average density of about 1/1000 of an atmosphere. Star 26, greenish; double, magnitudes, 2, 6.8; period, 5.7 days; Star 27, magnitude, 3.8; period, 3.7 days; Star 28, double, magnitudes, 3.4, 5; period, 8 days; Star 29, a great nebula; 650 light years distant; diameter, 5 or 6 light years or 30 or 40 million million miles. It is so rare that if the air left in the supposed vacuum of an electric light globe were expanded to the size of our capitol at Washington, it would approximate the condition prevailing there. Star 30, double nebula, magnitudes, 2.8, 7.3; period, 29 days; Star 31, Saiph, magnitude, 2.2; Star 32, Rigel, magnitude, .3; distance, 543 light years; blue-white; 18,000 times as bright as our sun; temperature, 28,800° F.

CHART V

CHART V

The constellation **Gemini** is responsible for the expression, "By Jiminy". Castor, Star 1, is an important double star, magnitudes, 2, 2.8, each part, six times as brilliant as the sun would be at an equal distance; orange-blue; 42 light years distant; period 306 years. Pollux, Star 2, the other of the "twins", magnitude, 1.2; diameter 14 million miles; 33 light years distant; Star 3, magnitude, 4.6; period, 19.6 days; Star 4, variable, magnitudes, 8 to 13; variation period, 288 days; Stars 5 and 6, barely visible; Star 7, variable, magnitudes, 3.2 to 4; variation period, 231 days.

The cluster Praesepe, Star 8, 363 suns; often referred to as a "beehive". The units vary in magnitude from 6 to 12, there being 173 in the main cluster. The cluster is about 600 light years distant. Star 9, variable, magnitudes, 8.4 to over 14; variation period, 305 days; Star 10, variable, magnitudes, 7.5 to 13; variation period, 256 days; Star 11, double, magnitudes, 5.3, 6.3; period, 60 years; Star 12, variable, magnitudes, 6 to 11.3; variation period, 362 days; Star 13, magnitude, 4.4; period, 131 days; Alhena, Star 14, the "Circlet", magnitude, 1.9; period, 2,175 days.

Procyon, Star 15, is the major star in the constellation of **Canis Minor,** or **the Little Dog.** It is 10.6 light years distant; 5½ times as bright as the sun; pale topaz color; surface temperature, 14,400° F. Except for Sirius, it is the closest to the earth of the larger stars. It is a double, magnitudes, 5, 13.5. Star 16, variable, magnitudes, 7.5 to 13.

Star 17 is in the constellation **Hydra** and has a period of 256 days. Star 18, double, magnitudes, 3.7, 5.2; period, 15.3 years; distance, 135 light years; mass, 3½ times the sun.

The constellation **Monoceros, the Unicorn,** includes stars 19 to 23. Star 19 is a cluster, 20 a very bright cluster, magnitude, 6. Star 21, variable, magnitudes, 7.2 to 12.9; variation period, 332 days. Star 22, double, with masses 86 and 72 times (?) that of the sun. The magnitude is 6.6, the period 14.4 days, and the distance, 10,000 light years. Star 23 is a cluster with a ruby-colored star in the center.

The constellation **Canis Major,** or **Great Dog,** is conspicuous because of Star 24, Sirius, the Scorcher. This star is a double, magnitudes, 1.6, 8.5; period, 49.3 years; distance, 8.9 light years; 30 times as bright as the sun; mass, 3.4 times that of the sun; surface temperature, 19,800° F., weight, on the average one ton for every cubic inch. Star 25 has a magnitude of 1.9; and a period of 6 years.

CHART VI

CHART VI

Ursa Major, the constellation of **the Great Bear,** extends into the area here represented and includes stars 1 to 5. Star 1, magnitude, 5.7; period, 15.98 days; Star 2, magnitude, 3.5; Star 3, magnitude, 4.8; period, 15.8 days; Star 4, magnitude, 6.6; a large, oblong nebula. Star 5 is known as the Runaway Star. Its velocity through space is such that, every two minutes, it moves a distance equal to the path of the moon about our earth. No other known star has such a velocity. In spite of this terrific speed, it apparently moves but the breadth of the moon in 300 years. This is because of its great distance from us, 21.7 light years.

Star 6 is in the constellation **Lynx,** has a magnitude of 3.3.

The constellation, **Leo Minor,** contains stars 7 and 8; Star 7, magnitude, 7.6; distance, 7.9 light years; Star 8, variable, magnitudes, 7 to 13; variation period, 370.5 days. The constellation, **Leo,** has as its most interesting star, Regulus. Star 9, double, magnitudes, 4.5, 8.4; period, 71.7 days; Star 10, magnitude, 3.1; Star 11, variable, magnitudes, 8.6 to 13; variation period, 273.1 days. Star 12 is Denebola, a star of 2.2 magnitude which is 25 light years distant from the earth. Star 13 is a luminous nebula and Star 14 is a spiral nebula. Star 15, double, magnitudes, 4, 7, shines with an amber-turquoise color. Star 16, magnitude, 3.8; period, 12.3 days. Regulus, Star 17, double, magnitudes, 1.3, 8.4, the chief star in the constellation, is 72.4 light years from the earth. It has a diameter of 3 million miles and is therefore about three and a half times as great in diameter as our sun. Regulus appears as a jewel in the handle of a sickle outlined by about six stars. It lies almost exactly on the ecliptic or the path made by the sun across the sky. It forms one angle of a conspicuous triangle, the other angles being at the stars Procyon and Pollux. Regulus appears conspicuously white. Star 18, also in the constellation Leo, is a variable star, magnitudes, 4.6 to 10.5; variation period, 312.8 days. Star 19, magnitude, 3.7; period, 14.49 days.

Stars 20 and 21 are in the constellation **Cancer, the Crab.** Star 20 has a magnitude of 5.1 and a period of 6.39 days; Star 21, double.

Star 22 is an oval nebula with a star center in the constellation, Leo, and Star 23 in the constellation **Virgo** has a magnitude of 3.8. This area has more nebulae than any other similar area in the heavens. Star 24, in the constellation **Sextans,** double, magnitudes, 5.8, 6.1; period, 72.76 years; Star 25, in the constellation **Hydra,** magnitude, 2.2; distance, 226 years. Star 26 is an elliptic, pale, steel-blue nebula.

CHART VII

CHART VII

Canes Venatici. Star 1, Alcaid, has a magnitude of 1.9 and is 108 light years distant. Star 2, spiral nebula of enormous size, occupies a space equal to 20 million times the orbit of Neptune about the sun and, though whirling incredibly fast, it takes over 45,000,000 years to make one revolution. Star 3, variable, magnitudes, 6.1 to 12.7; variation period, 326 days; Star 4, Cor Coroli, double, magnitudes, 2.9, 5.7; period, 5.5 days; Star 5, double, magnitudes, 5, 5.8; period, 220 years; Star 6, double, magnitudes, 7.2, 7.7; period, 48 years; Star 7, a globular cluster visible with the unaided eye on a clear night; composed of several hundred thousand suns; 60,000 light years distant from the earth. This distance is so great that were our sun magnified twice and placed in the center of this cluster, it would be too small to be visible on a photographic plate. It requires light 65 years to cross its angular diameter. Star 8, double, magnitudes, 7.6, 8; period, 199 years.

Coma Berenices. Stars 9, 10 and 11 barely visible.

Bootes, the Hunter. Star 12, double, magnitudes, 7.5, 8; period, 97.93 years; Star 13, magnitude, 4.83; period, 211.95 days; Star 14, double, magnitudes, 4.8, 6.4; period, 159.54 days; Star 15, variable, magnitudes, 6.6 to 12.9; variation period, 223.3 days; Star 16, double, magnitudes, 4, 8; period, 9.6 days; Star 17, double, magnitudes, 4.8, 6.4; variation period, 159.54 years; Star 18, Arcturus, magnitude, 0.2; diameter, 21 million miles, or twenty-four and a half times that of the sun; 40 light years distant; 1/5000 as dense as water. From Arcturus to the handle of the Big Dipper is 40 degrees. Star 19, double, magnitudes, 4.4, 4.8; period, 130 years; Star 20, double, magnitudes, 7.8, 8.8; period, 238 years; Star 21, double, magnitudes, 2, 8; period, 497.1 days; Star 22, double, magnitudes, 6.3, 6.3; period, 23 years; Star 23, double, magnitudes, 5.5, 6.8.

Virgo, the Virgin. Star 24, magnitude, 3; Star 25, variable, magnitudes, 6.4 to 12.1; variation period, 145.47 days; Star 26, variable, magnitudes, 8.7 to 13.5; variation period, 339 days; Star 27, variable, magnitudes, 8 to 12; variation period, 438 days; Star 28, double, magnitudes, 3.6, 3.7; period, 182.3 years; Star 29, magnitude, 3.4; Star 30, variable, magnitudes, 4.8 to 6.2; variation period, 2.327 days. This star has an eclipse whose duration is 13 hours. Star 31, Spica, magnitude, 1.2; white; period, 4.01 days; 227 light years distant from the earth; Star 32, double, magnitudes, 8.6, 14.5; period, 218.8 days.

Corvus, the Crow. Stars 33 and 35, in **Hydra.**

CHART VIII

CHART VIII

Bootes. Star 1, double, magnitudes, 5.3, 6.2; period, 204.74 years; Star 2, double, double, magnitudes, 4.4, 6.5, and 7.2, 7.8; period of last two, 244.37 years.

Northern Crown, Corona Borealis. Star 3, variable, magnitudes, 7.2 to 12; variation period, 358 days; Star 4, double, magnitudes, 5.6, 6; period, 41.5 years; Star 5, Gemma, magnitude, 2.3; period, 17.36 days; distance, 62 light years; Star 6, double, magnitudes, 4,7; period, 87.8 years; Star 7, variable, magnitudes, 7.3 to 14.2; period, 486 days.

Hercules. Star 8, nebula; Star 9, magnitude, 3.6; Star 10, variable, magnitudes, 7.8 to 13.5; variation period, 280.2 days; Star 11, double, magnitudes, 3, 6.5; period, 34.46 years; Star 12, magnitude, 3.9; period, 4 days; Star 13, double, magnitudes, 3.5, 9.5; period, 43.23 years; Star 14, variable, magnitudes, 8 to 12.5; variation period, 221 days; Star 15, blue-green nebula; Star 16, magnitude, 2.81; period, 410 days; Star 17, double, magnitudes, 3.8, 8.2; Star 18, double, magnitudes, 3.1, 6.1; diameter, 185,800,000 miles; 21.7 light years distant; Star 19, variable, magnitudes, 8.6 to 14.8; variation period, 317.7 days.

Serpens. Star 20, variable, magnitudes, 5.6 to 13; variation period, 357.3 days; Star 21, double, magnitudes, 3.7, 9.1; Star 22, Serpentis, magnitude, 2.8.

Ophiuchus. Star 23, variable, magnitudes, 7.3 to 12.6; variation period, 308.3 days; Star 24, magnitude, 2.1; distance, 60 light years; Star 25, magnitude, 2.9; Star 26, double, magnitudes, 4, 6.1; period, 134 years; Star 27, magnitude, 4.4; Star 28, double, magnitudes, 4.9, 6.2; period, 46 years; Star 29, magnitude, 4.6; period, 26.27 days; Star 30, double, magnitudes, 5.3, 6; period, 223.82 years; Star 31, variable, magnitudes, 7 to 10.5; variation period, 302.5 days; Star 32, variable, magnitudes, 3.8 to 13; variation period, 233.8 days; Star 33, magnitude, 2.9; period, 6.8 days; Star 34, double, magnitudes, 3, 8; period, .247 days; Star 35, Antares, magnitude, 1.2; 360 light years distant from the earth; diameter, about 450 times that of the sun. If the sun and its system were to occupy the same space, the earth would be buried throughout its orbit, as would also Mars. 121 million million worlds could crowd into Antares. It is a mammoth globe of incandescent gas whose density is .00001 that of water. It is said that it would take a million and one-third of earths to make one sun, 27 million suns to make one Betelgeuse and 91 million suns to make one Antares.

CHART IX

CHART IX

Lyra, the Lyre. Star 1, Vega, magnitude, 0.1, brightest first magnitude star in northern heavens, about 50 times as bright as our sun; distinctly blue-white. 1500 Vegas would give more starlight than all the stars in our heavens; 26 light years distant, or about 8 million times as far from the earth as the earth is from the sun. Our solar system is moving towards Vega at the rate of 400 million miles a year. In about 12,000 A. D., Vega will be our polestar just as Polaris now is. Star 2, magnitude, 4.3; period, 4.3 days; Star 3, double, magnitudes, 4.5, 6.5; period, 245 days; Star 4, double, magnitudes, 3.6, 7; period, 12.9 days; Star 5, a ring nebula; Star 6, double, magnitudes, 5.2, 8.7; period, 45.8 years; Star 7, double, magnitudes, 3, 7.9.

Cygnus, the Swan. Star 8, Deneb, double, magnitudes, 1.3, 12; distance, 650 light years. Though at a great distance, it is very brilliant and though it seems less brilliant than Sirius it is ten thousand times brighter than our sun. Star 9, magnitude, 4.7; period, 2.8 days; Star 10, magnitude, 2.3; distance, 540 light years; Star 11, double, magnitudes, 5, 6.3; Star 12, the eastern arm of the Northern Cross, magnitude, 2.6; Star 13, variable, magnitudes, 4 to 13.5; probably larger than Mira; variation period, 406 days; Star 14, double, magnitudes, 8.2, 8.2; period, 243.9 years; Star 15, Albireo, double, magnitudes, 3, 5.3.

Hercules. Stars 16 to 19 not conspicuous.

Vulpecula, the Fox. Stars 20 and 21 not conspicuous; Star 22, the Giant Dumbbell, Nebula.

Sagitta, the Archer. Star 23, double, magnitudes, 5.4, 6.4; period, 25.2 years.

Delphinus, the Dolphin. Star 24, double, magnitudes, 4, 5; Star 25, variable, magnitudes, 8.4 to 12; variation period, 277.5 days. Star 26, double, magnitudes, 4, 5; period, 26.8 years; Star 27, nebula; Star 28, double, magnitudes, 5.8, 6.3; period, 97.4 years.

Aquila, the Eagle. Star 29, Altair, blue-white, magnitude, 0.9, or nine times as bright as our sun; 15.4 light years distant; Star 30, variable, magnitudes, 7.6 to 13; variation period, 284.4 days. Star 31, distance, 112 light years; magnitude, 2.8; Star 32, variable, magnitudes, 5.8 to 12; variation period, 355 days; Star 33, variable, magnitudes, 6.5 to 9; variation period, 335 days; Star 34, nebula; Star 35, double, magnitudes, 4.1, 6; period, 87.8 years; Star 36, not visible to naked eye.

Aquarius. Stars 37 and 38; **Scutum.** Stars 39, 40 and 41; **Capricornus.** Star 42; **Sagittarius.** Stars 43 to 49.

CHART X

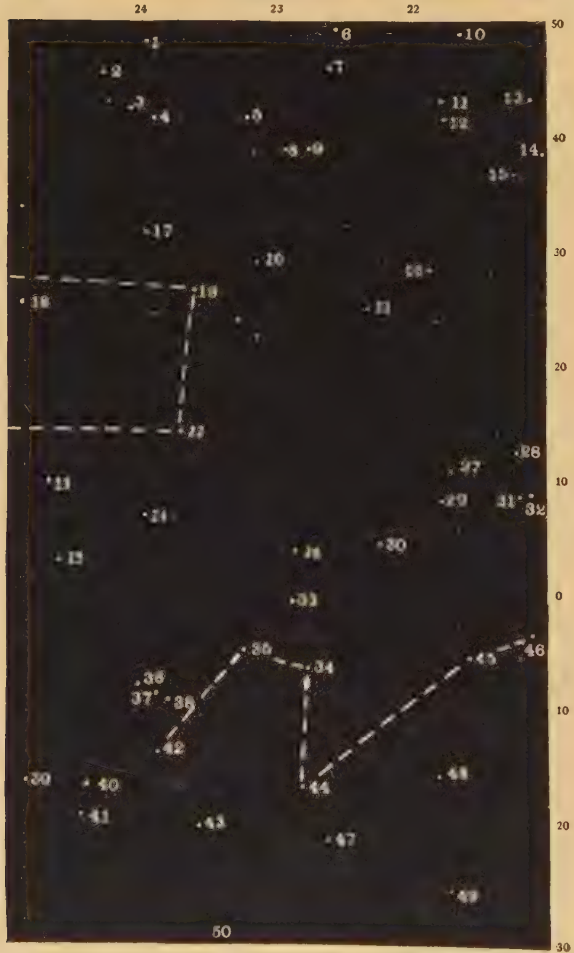


CHART X

The area here covered is relatively poorly supplied with important stars.

In the constellation, **Andromeda,** we have Star 1, a rose-colored star, magnitude, 5; Star 2, magnitude, 4; period, 20.54 days; Star 3, a bright blue-green, elliptic nebula; Star 4, magnitude, 5.9; period, 3.22 days.

The constellation, **Lacerta, the Lizard,** shows Star 5, variable, magnitudes, 8.3 to 14.5; variation period, 298.7 days; Star 6, a cluster; Star 7, magnitude, 4.6; period, 2.6 days; Star 8, a double double with magnitudes of 6.5, 6.5 and 8.5, 10; Star 9, magnitudes, 8 to 12.5.

The constellation, **Cygnus,** shows us Star 10, a cluster; Star 11, a variable; magnitudes, 8.4 to 12; variation period, 103.6 days; Star 12, a triple, magnitudes, 7, 7.9, 11; Star 13, a nebula; Star 14, double, magnitudes, 5.3, 5.9; brightness, .064 as bright as the sun; Star 15, double, magnitudes, 3.8, 8; period, 47 years; Star 16, double, red-gold to purple; magnitudes, 4, 5.

Pegasus is represented by Star 17, a double, magnitudes, 5.5, 7.5; Star 18, double, magnitudes, 5.8, 11; period, 26.4 years; Star 19, Scheat, whose diameter, 150 million miles, would enclose 5,000,000 suns; distance 541 light years; magnitude, 2.2; Star 20, magnitude, 3.1; period, 818 days; Star 21, magnitude, 3.6; period, 10.21 days; Star 22, Markab, magnitude, 2.6; distance, 272 light years; Star 23, double, magnitudes, 6.9, 7.3; Star 24, variable, magnitudes, 7.8 to 13; variation period, 317.5 days; Star 25, a glowing ember, magnitude, 6.2; Star 26, a double, magnitudes, 5.8, 7.2; Star 27, a globular cluster; Star 28, a variable, magnitudes, 8 to 12; variation period, 262 days; Star 29, a triple, contrasting colors; magnitudes, 2.5, 8.8, 11.5; Star 30, variable, magnitudes, 8.2 to 14; variation period, 303 days; Star 31, double, magnitudes, 5.3, 5.4; period, 5.7 years; Star 32, a triple, magnitudes, 4.1, 5.7, 11; Star 33, double, magnitudes, 4, 4.1; Star 34, double, magnitudes, 5.6, 5.7; Star 35, triple, magnitudes, 7, 7.5, 8; Star 36, double, magnitudes, 7, 8; Star 37, double, magnitudes, 7, 8; Star 38, double, magnitudes, 4, 8.5; Stars 39 to 47 either invisible to the naked eye or nearly so, and relatively unimportant.

Capricornus, Star 48, magnitude, 3; Star 49, magnitude, 5.

Fomalhaut, Star 50, magnitude, 1.3 and distance, 25.51 light years, is seen in autumn in the constellation, **Pisces Australis,** or **Southern Fish.**

How to Make a Planisphere

A PLANISPHERE for finding the common northern constellations may be made by cutting out, or tracing, the sections on the right.

Mount the circular map on a stiff piece of cardboard and cut it out in a circular form.

Mount the frame similarly and cut out the areas indicated to be removed.

Select a third card, the size of the frame, and lay it on a table. On each of the corners lay one or two thicknesses of card such as was used to mount the map. Place the map in the center of this third card and fasten the corner pieces with glue so that the map has only slight opportunity to get out of position. Place the frame over the map and the other cards. Fasten the frame to these cards with tape or *passe-partout* so that the map may be moved about inside the frame and the third card enclosure.

To locate a major constellation follow the directions on the front of the frame. Do not expect to find all of the constellations at any one time of the year.

NOTE: If it is desired that the printed planisphere be cut out do not remove this column since the general directory of stars and constellations is printed on its back. This should remain with the text for convenience. A copy may be made of the list of references on the reverse of the planisphere plan.

Midnight
To locate constellations
Turn map until the proper date lies above proper hour. Hold constellation finder above head so that Eastern horizon, as indicated below, is to the East
Constellations will be found as indicated from horizon to horizon
Evening
Western horizon
Cut out
Cut out
Cut out
Cut out
Morning
Eastern horizon
Noon

This special educational insert—as well as those in the October and December issues and those to follow—is so placed in the magazine that it may be detached and preserved in a note-book cover. This insert, in particular, will be found useful in connection with Nature Magazine's regular astronomy article by Isabel M. Lewis, a feature long popular with the sky-minded readers of the magazine.

ACKNOWLEDGMENT

THIS outline for the study of the stars is modified from a similar article prepared by the author and published in a more comprehensive form as *Cornell Rural School Leaflet,* Volume 23, Number 3, in January, 1930. The revision is made with the permission of the New York State College of Agriculture, publishers of the initial article.

As has been the case in the preparation of similar articles on other subjects, the author has supplemented his own experiences with those of others, and has, of course, received help from books. In the preparation of this material particular credit is due to Professor S. L. Boothroyd of the College of Civil Engineering of Cornell University, who reviewed the manuscript and made many helpful suggestions. The books found most useful in the preparation of this material and to which acknowledgment is due are as follows:

Introducing the Constellations, by Robert H. Baker, The Viking Press, New York City, 1937.

When the Stars Come Out, by Robert H. Baker, The Viking Press, New York City, 1934.

The Universe Unfolding, by Robert H. Baker, Williams and Wilkins Company, Baltimore, Md., 1932.

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THE SKY AT NIGHT

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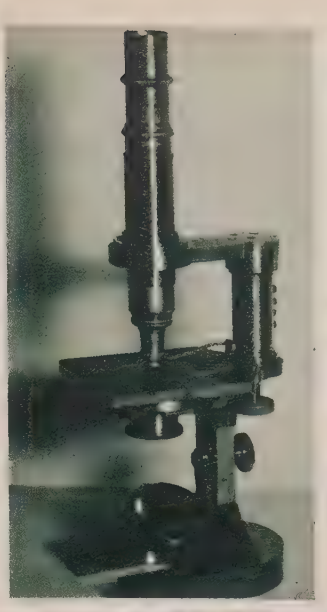
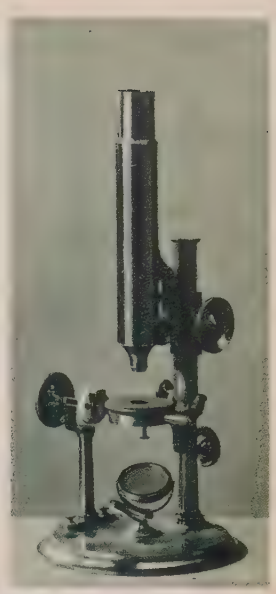
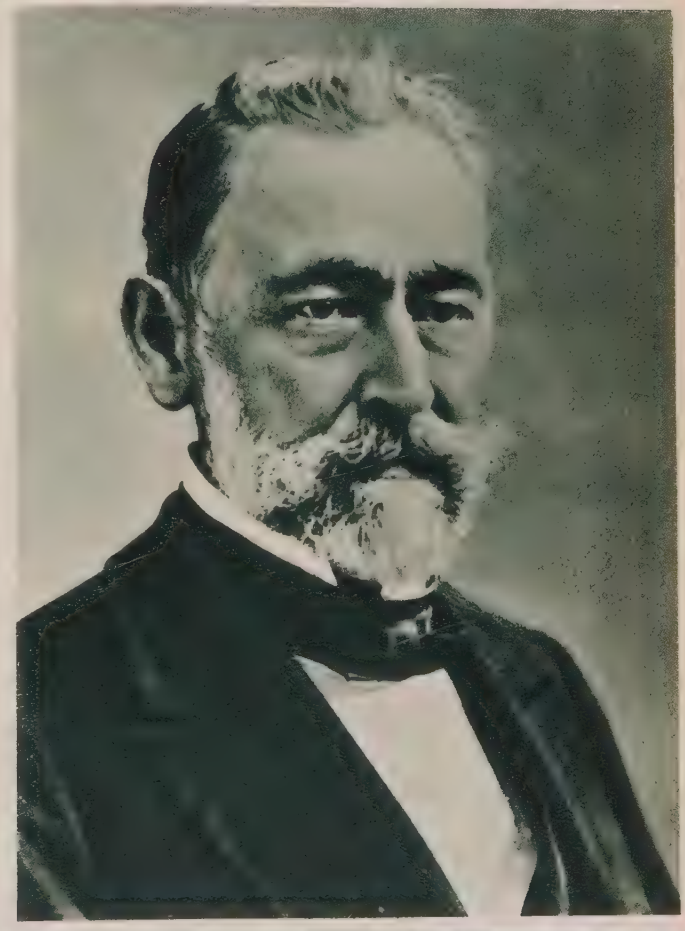


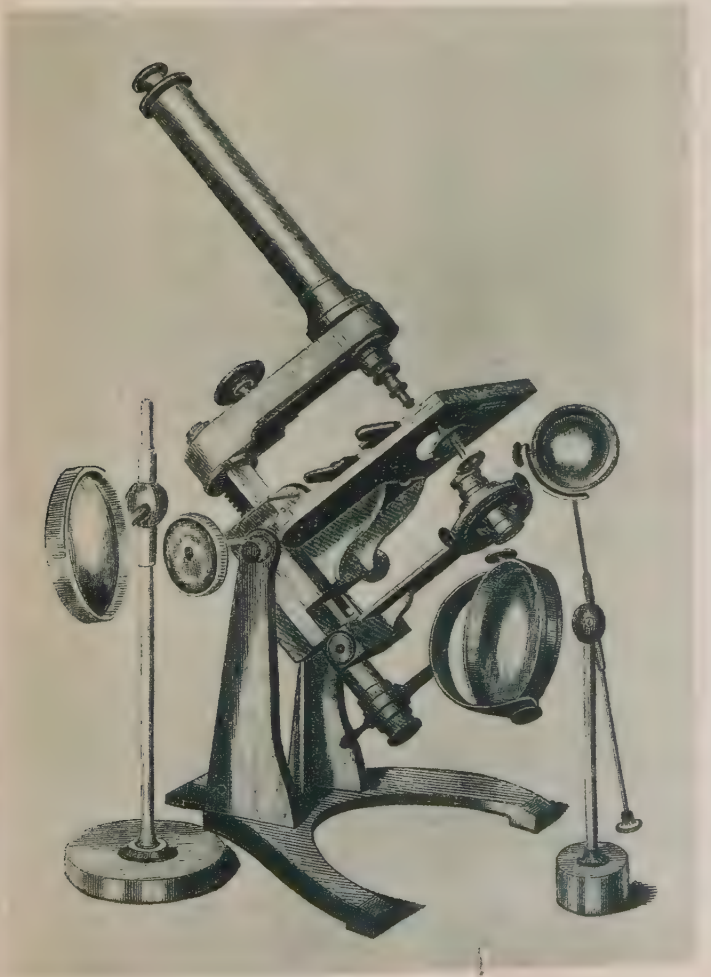


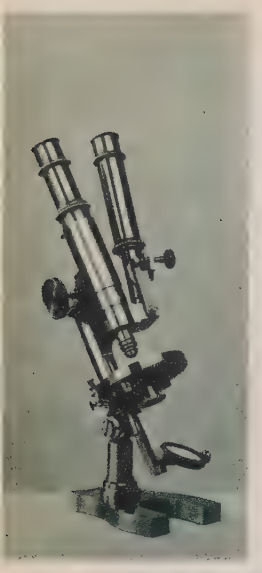
America entered the field in the person of Charles A. Spencer (1813-1881), born in Canastota, N. Y. He made several microscopes before 1847, but in that year produced the first American instrument for commercial sale and founded the firm known today as the Spencer Lens Company, located at Buffalo, N. Y. Spencer's trunnion microscope was equipped with an inclination joint and the lever type of side fine adjustment.

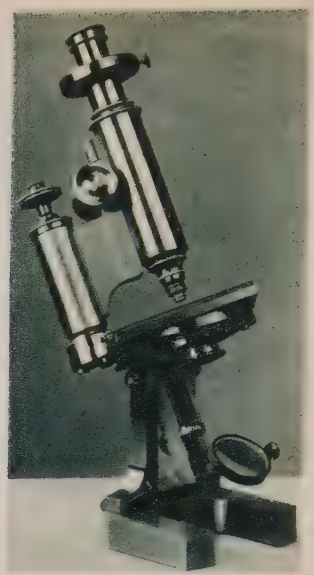
●

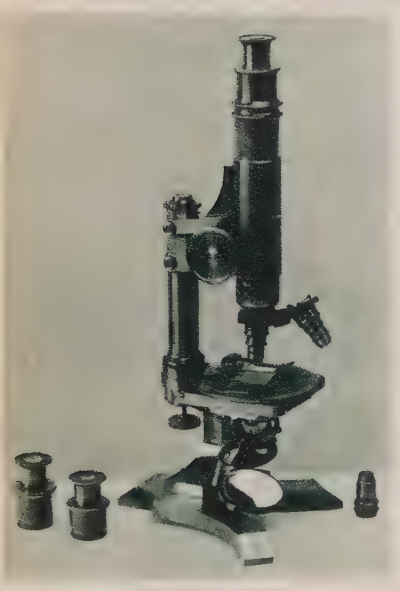
Above, left to right, an early optical lathe, or bench. Courtesy Spencer. Zeiss microscopes of 1850 and 1858, and microscope by Norbert, Barth, Pomerania, 1860. Courtesy Zeiss. Right, Charles A. Spencer, and, below, Spencer Trunnion Microscope, 1847. Lower right, so-called sun microscope for use with sunlight. Courtesy Zeiss.









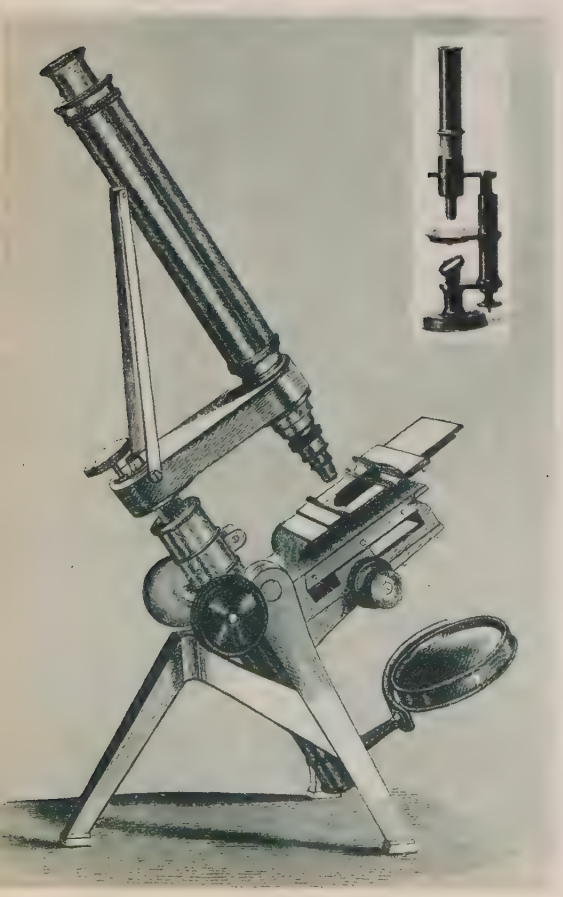


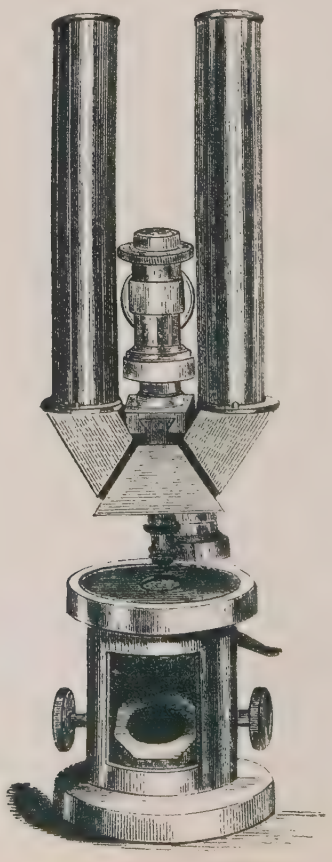
Before 1825, if you were a university professor and wanted a microscope for use in research or teaching, you had to make one yourself or call to your assistance some amateur expert in optics. Apparently the first man to manufacture a microscope for sale was Dr. C. L. Chevalier, Paris physician, 1825, who made many improvements in objectives and was so successful that he founded the firm of Chevalier and Son.

The demand began to increase and the first half of the nineteenth century saw the establishment of a number of companies for the commercial production of microscopes. Nachet began in Paris in 1845. In England, Smith and Beck associated as a firm of that name, now R. and J. Beck, Ltd., of London. Andrew Ross entered the field in 1832 and contributed certain notable improvements.

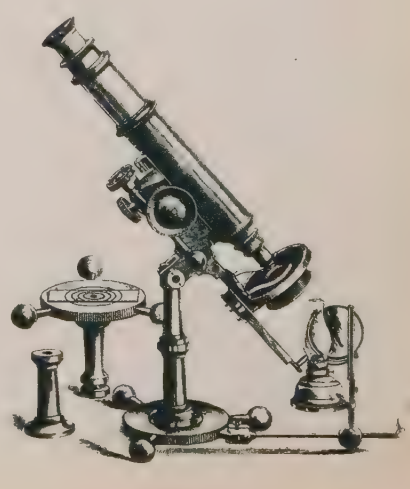
The year 1832 in England also witnessed the association of Powell and Leland to establish the London firm of that name. Carl Zeiss, at Jena, Germany, began in 1846, while Ernest Leitz acquired the Wetzlar, Germany, works of Kellner in 1889. In America, after Spencer, came the firms of J. W. Queen & Co., about 1856, and Joseph Zentmayer, 1877, both of Philadelphia.

Competition resulted in the closing of many of these nineteenth century companies, while others still flourish today. Most firms did business in a few





Top, left to right, Nachet binocular, 1870, prism at side of central tube; Smith-Beck binocular, London, 1860; binocular by Ross, London, 1865; Hartnack, Paris, before 1871. Courtesy Zeiss. Center, left, Seibert and Kraft, Berlin, 1870, quite modern-looking. Below, left, Powell and Leland's large compound microscope (courtesy Spencer) with inset of monocular body by C. Kellner, Prussia, 1850. Courtesy Leitz. Center, early Nachet binocular, 1870, and, to its right, Griffith Club microscope. Courtesy Spencer.



small rooms and each instrument was handmade by one workman from start to finish, metal work, lens grinding and assembly. Highly skilled craftsmanship still obtained, with no machinery other than crude lens-grinding lathes.

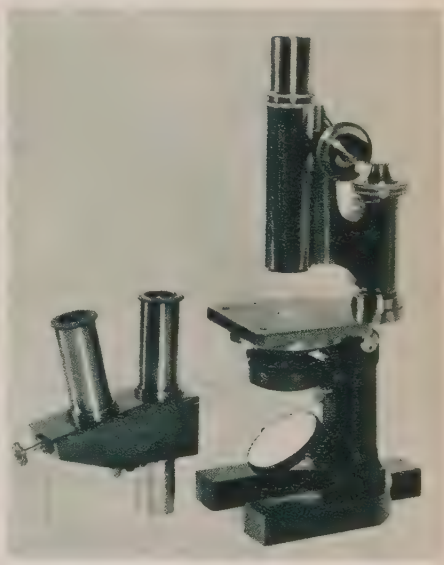
William Watson and Sons Company, of London, who have recently celebrated their centennial in business, entered the microscope field in 1889.

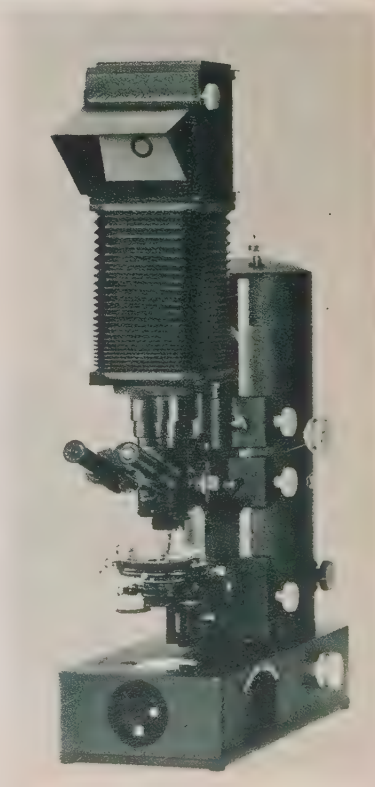
In 1853 John J. Bausch, a poor immigrant from Germany, began a small optical business in Rochester, N. Y., and was joined two years later by his friend, Henry Lomb, thus establishing the firm of Bausch & Lomb. Edward Bausch, son of the founder, made his first microscope in 1872 and, having the facilities of an already organized factory at his command, soon began the active manufacture of these instruments. He is notable as the first to introduce modern methods of quantity production to this business.

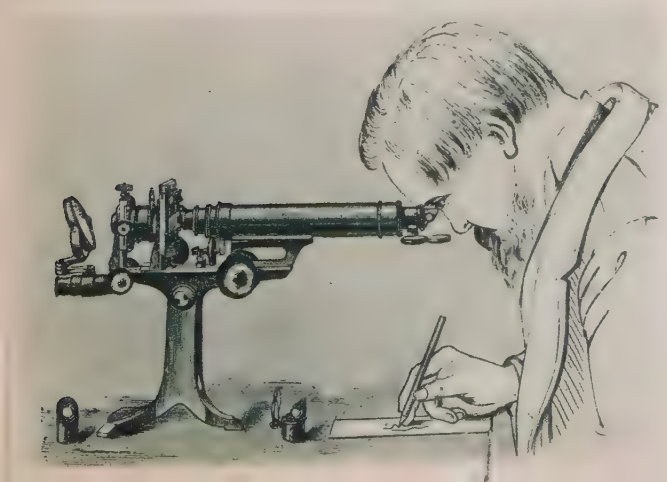
Toward the end of the nineteenth century Professor Abbé, of the University of Jena, Germany, made important improvements in highly corrected objectives and introduced the substage condenser bearing his name, which is in general use today. He also designed a refractometer for the measurement of indices of refraction and adapted Wollaston's camera lucida for use with the microscope. This device permits direct tracings on drawing paper while one is looking into the microscope, as here pictured.

Prior to the twentieth century, most colleges owned only a few microscopes for demonstration purposes, and the demand from research scientists and physicians was light and sporadic. Since 1900, however, the call for these instruments has increased enormously, not only colleges but high schools as well requiring large numbers of the student type of microscope. Physicians, medical colleges and hospitals, and health departments of cities, became major customers along with the rise of bacteriology to a place of importance among the sciences.

Craftsmen were now trained to perform single tasks and to make their one job a life work and study, thus developing speed along with a high degree of skill. Designers, mathematicians, engineers and manufacturers pooled their specialized knowledge to set up production standards, and this era saw refinement and standardization of construction go hand in hand with quantity of output.







At top an interesting comparison of Zeiss and Bausch and Lomb microscopes of 1872. Center, a Zeiss instrument of 1876 (at the right) and one of J. Swift and Son, about 1900, the latter typical of many British makes of this century. Courtesy Zeiss. At the left an artist is making a drawing with the camera lucida. Courtesy Spencer Lens Company. At the right, interesting by comparison, is a Zeiss photomicrographic microscope with binocular observation body, built-in light source, and many advanced features.

Today the microscope has escaped from the cloisters of learning and has invaded every major industry. Chemists analyze unknown substances, metallurgists study grain structure of various metals; glass, crystals, rocks, steel, leather, foods, drugs, paints, textiles, paper—these are but the more obvious materials that pass daily under the scrutiny of high-powered lenses in our complex industrial civilization.

Latest among the sciences to develop and demand special optical apparatus is criminology. The specialist in this field must examine singly and also make comparisons of hairs, finger prints, bullets and a great many other objects, and for these purposes he needs a greater variety of microscopes than any other scientists. Thus the story of microscopes, most important of all instruments. Today the expert uses dark field, polarized, ultra violet and infra red lights, with oil immersion lenses of fluorite. Has the limit been reached? Who can say what the future holds?

Above, in a "still" from Warner Brothers' picture "From Headquarters" are the latest in microscope equipment used in criminology—reversed type research microscope (left, foreground) and bullet comparison microscope. At right Edward Bausch holds his first microscope (1872) and compares it with the latest research instrument. Below, right, a modern microprojector. Below, inset, a quality miniature microscope for amateurs. Courtesy Bausch and Lomb. Below, binocular body on high-powered monocular stand, side fine adjustment and special powerful lamp with its own focusing gear. Courtesy Bausch and Lomb.

★ Conservation ★

A part of Nature Magazine each month is devoted to the expression of practical opinions on the vital issues affecting our use and abuse of natural resources, including wildlife, and dedicated to the purpose of assisting Americans to play a militant part in the attainment of constructive conservation aims.

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PRACTICAL ★ ★ IDEALISM ★ ★ AND OUR PARKS

Of all the alarming trends in our muddled world today, the most disquieting is the abandonment of ideals. It was Carl Schurz who said: "Ideals are like stars; you will not succeed in touching them with your hands. But like the seafaring man on the desert of waters, you choose them as your guides, and following them you will reach your destiny." Yet, today, we see ideals sacrificed to whim, personal ambition, greed and expediency, or, what is worse, distorted by small minds without vision. And it is one of the peculiarities of ideals that their loss may come so subtly that we have no warning of the pain of the irreparable loss to come.

In our December issue, Henry Baldwin Ward answered, generally, the question, "What Is Happening to Our National Parks." In this issue, in the pages that follow, Bernard Frank asks if we must say "Farewell to the Smokies", a specific answer to Dr. Ward's question.

These two articles will be regarded by some as attacks upon the National Parks; by others as gratuitous criticism of the whole National Park Service; by others as an assault upon the National Park system itself. Actually both are defenses of the ideals upon which the National Park program was established. These ideals need such defense today because they are too often being twisted out of recognition or conveniently forgotten. In the process, we, as a people, are losing something we can never replace.

So these two articles, and this editorial, are published in no spirit of enmity, but, rather, of deep friendliness. Sometimes, even your best friends *will* tell you.

At a National Park Conference held in Washington, D. C., early last year under the auspices of the American Civic and Planning Association, we were introduced to the "practical idealist" in National Park administration. From the same platform we heard sincere words of unswerving loyalty to the original ideals by men in the rank and file of the Service. But those in command swore fealty to these ideals when it was "practical" to observe them.

What, then, is a "practical idealist" in National Park control? It is one willing to admit swank hotels, golf courses, swimming pools, beer parlors, skating rinks, dance halls, or any other entertainment incongruity to a National Park if "the public demands it", or if political pressure prescribes. The "practical idealist" will fight for ideals only so long as it is safe and expedient. He is proudest of the statistics showing the number of miles of paved road, of highway engineering masterpieces, of first class trails, and, most of all, of the figures showing the increasing horde of visitors. The facilities of the Parks, he says, must be extended—in whatever direction—to care for this great public demand. And, of course, these figures are of much help in getting appropriations.

In all fairness it must be pointed out that the recent era, of easy public money and of Federally-subsidized labor, has put upon the National Park Service the task of finding work for idle hands to do. Highways, trails and fire roads have been extended; other developments that were neither needed nor, in many cases, desired, have resulted. Yet this trend has an insidious character, distorting fundamental policy and becoming habit-forming. It has certainly done no good to National Park ideals.

What are some of the results of such trends? Through over-civilization and over-development, the inspiration to be derived from our National Parks is seriously diluted, as is, also, the opportunity for real recreation. The spirit of adventure is supplanted by "all the comforts of home". The progressive "sissyfication" of the American people is abetted. Man's planning is substituted for Nature's plan.

We read that fifteen million people visited the various reservations under National Park Service control last year. Even allowing for duplication, that is a lot of people. But are we justified in sacrificing quality in our National Parks in order to attract quantity to them? Must ideals be tempered to the lowest standards of the many, or should they

be maintained in order to bring those standards up?

Let us cite two true stories.

One is of the man who, standing high on the slope of one of the peaks in Glacier Park, pulled from his pocket an empty envelope. With a smile, he said, "Funny, isn't it, but I've been carrying this around for five days trying to find a place to throw it away." And he stuffed it back into his pocket.

The other story is of a conversation overheard on a Sunday in a washroom in Yosemite. Two youths, just arrived from a large city in an ancient automobile are talking.

"Do they dance in this jernt?" asks one.

"I dunno does they dance in this jernt," says his companion.

"No, there is no dancing here on Sunday," volunteers another visitor.

"What! No dancin'! Fer Gawd's sake, what do they expect yer to do here, look at the scenery?"

To which level should National Park Service ideals be keyed? We've picked ours. You choose yours.

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PROSPECTS FOR REORGANIZATION

Having no crystal ball or other aids to clairvoyance, we may be unwise to attempt to forecast the form in which the cadaver of government reorganization, irreverently buried by the last Congress, may be resurrected for the delectation of the new Congress. It seems evident, as this is written, that its ghost, at least, will walk again. Mr. Roosevelt still cherishes its memory, and there are others with more than an academic interest in this legislative reincarnation.

Indications are that the proposals of the totalitarian measure of the last session may reappear in several separate pieces of legislation. It is more than likely, also, that the bills will pay more deference to the will of the legislative branch and provide for its approval of the specific form of such reorganization as may be undertaken.

Beside its blanket character, offensive to many, the reorganization bill of last year tried to cover so much ground that opposition came from a wide variety of quarters and bulked larger and larger as the fight went on. Separate bills would permit a much fairer opportunity for the crystallization of ideas and less confusion through heterogeneous opposition. There is no doubt that a bureaucratic structure, erected with the recent speed and stress that ours has encountered, could well stand refurbishing. This is a process, however, that should be based on the best thought and study.

Our interest in the 1938 bill centered in the elusive proposal to rechristen the Department of the Interior, calling it the Department of Conservation. We opposed the bill because of this very elusiveness and because there appeared to be no guarantee of distinction between real and bogus conservation activities. We felt, and still feel, that there must be administrative separation of renewable from nonrenewable natural resources. And we further believe that the conservation philosophy of the Department of Agriculture is far better than that shown, in the main, by the record of the Department of the Interior.

One salutary result of the reorganization flurry has been to inspire Secretary of Agriculture Wallace to order and effect greater coordination between the several important conservation agencies under his wing. He has appointed a group known as the Agricultural Program Board to "scrutinize all plans (of this Department) especially in the light of administrative feasibility and practicality" —to integrate the interests of agriculture, soil conservation, forestry and wildlife into a broad national land-use policy, and to become in short a "channelizing agency" for eliminating the conflicts of overlapping bureau projects. Already all land-use programs involving conservation on farm lands are being consolidated through the Soil Conservation Service. It is rumored that the next step may be to secure authorization for a number of Regional Assistant Secretaries of Agriculture, whose chief function will be to interpret the policies of the administration and translate them into administrative plans within each region. Each such regional secretary would have under him a regional director of land use to integrate and channelize all functional activities for that region.

This last step we think is in accord with existing needs and, when added to Secretary Wallace's already promulgated reorganization steps, is the best possible answer to the carefully fostered clamor for a Department of Conservation. It seems far simpler and more practical thus to repair and adopt an existing fundamentally sound machine than to tear it all up and construct a new experimental vehicle out of used parts—which is exactly what a Department of Conservation would be.

Secretary of the Interior Ickes, having denied himself a mayoralty battle in Chicago, has not abandoned his hopes for a Department of Conservation that he presumably would head. He sincerely feels that he is the answer to every conservationist's prayer. It is more than likely, therefore, that conservation reorganization will be actively before the Congress.

It is devoutly to be hoped that conservationists will at least have an opportunity to consider and to support or oppose, as their convictions dictate, a specific piece of legislation providing for a definite plan.

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Unbalanced

By OSCAR OSTLUND

When farmers dried
Great sloughs to raise more corn;
Wild birds died,
And clouds of dust were born.

MOUNT GUYOT AND MOUNT CHAPMAN FROM BRUSHY

The eastern section of Great Smoky Mountain National Park is the more primitive, but graded horse trails are injuring this quality. Photograph by A. G. Roth

FAREWELL TO THE SMOKIES

By BERNARD FRANK

We believe this article to be a sound and logical sequel to Dr. Henry Baldwin Ward's discussion of what is happening to our National Parks in our issue of December, 1938. Dr. Ward dealt generally with the philosophy of National Park administration today. Mr. Frank deals specifically with that philosophy as manifested in the "development" of one Park. We further invite attention to editorial comment appearing on Page 97 of this issue.

THE selection of the Great Smoky Mountains in Tennessee and North Carolina for a National Park clearly is in conformity with the highest Park standards. Superlative in natural beauty and primitive quality, rich in native folklore, mystic and fascinating, the Smokies fully deserve the glowing picturizations of Horace Kephart and other writers.

The Smokies have much in common with the Olympics, another unique area recently selected for a National Park. Like the Olympics they lie in a region of severe and excessive precipitation, glory in the finest remaining virgin timber of the region, and possess an amazing luxuriance and variety of flora. Their stands of spruce have been estimated to run as high as 80,000 board feet per acre, and individual spruce and hardwood trees from five to nine feet in diameter or more have been observed. Though they boast of no eternal mantle of snow and ice, and lack a thousand odd feet of equalling the altitude of the Olympics, nevertheless the Smokies approach them in the grandeur of their panoramas, their solitude, the misty quality of the atmosphere, the rugged topography and the density and quality of their growth. Indeed the upper slopes of the eastern range are startlingly similar to those of its western counterpart below timberline. And while they offer no adventures to the hardy in glacier climbing, the Smokies do offer ample opportunities for cliff scaling, and, in winter, the joys and rigors of laboring up steep ice and snow-bound ravines and mountainsides.

This is the picture of the Smokies as Horace Kephart knew them, and even as late as 1934, shortly after their establishment as a National Park. Unfortunately, a combination of circumstances threatens to alter this picture for the worse, if not, perhaps, to destroy it altogether.

During the past five years a series of highly artificial developments have been undertaken that have already caused considerable damage, and in some cases irreparable injury to the primeval and wilderness character of the area. And, if continued as planned, these developments threaten to nullify the very purposes for which the Park was created.

What I have to say concerning the extent and character of this damage, and its effects upon the native vegetation, the scenic values, and the soil itself, is based on four years of observation, from March, 1934 to April, 1938. During this period I hiked and explored on all types of native and graded trails over some 1200 miles of the Park, chiefly, though not entirely, on the Tennessee side, and along all but nine of the 71 miles of its crest along the Tennessee-North Carolina line. I have also driven over the several hundred miles of roads of various types along and within the Park boundaries on both sides and have flown over a fair portion of its area.

The development of the Park is plainly aimed at making practically all of its parts easily accessible by road or

TWO CONTRASTING VIEWS OF INDIAN GAP IN THE SMOKY MOUNTAIN PARK, A WILDERNESS GEM NOW DESTROYED

In the larger picture we see the Gap in 1928 before its destruction by the Skyline Road. In the smaller picture we see the same scene in 1935, with parking area and curbing being installed. Both photographs by Harvey Broome

graded trail. To date apparently the only restrictions to easy access apply to the Raven Fork and Ramsey Prong sections, which possess the most magnificent examples of virgin hardwoods and spruce. These sections have been designated as a *Natural Research Area* covering over 23 square miles, or some three per cent of the gross Park area. Even here, however, the restrictions have been loosened on at least one occasion to permit a Trail Riders expedition up the Raven Fork, despite the fact that this necessitated the clearing out of a route sufficiently wide for horseback travel.

The desire to open the Park to the visiting public, insofar as it conforms with basic primeval park principles, is laudable enough. What *is* objectionable, however, is the extent and manner in which this desire has been achieved. It has become increasingly plain that road and trail construction have occurred, not so much as part of a balanced, carefully thought-through recreational program in harmony with the main objective of preserving the natural environment, but more as a means of qualifying for CCC camps and providing ample work for them, satisfying demands of commercialized local tourist-boosting organizations, and giving expression to ideas of landscaping and construction more fitting to state and city parks. Moreover, in so doing, the Park Service has used as a pattern the developments in many western Parks, despite the entirely different climatic and soil conditions and modes of travel prevailing in the humid East.

From 1933 to date the Park Service has built or improved more than 147 miles of fire and other type road in the Park, 477 miles of graded horse trail (mostly four-foot tread, five-foot clearing), and 22 miles of foot trails (two-foot tread). In addition it has built about seven and a half miles of so-called Skyline road extending from Newfound Gap to the base of Clingmans Dome, the highest peak in the Smokies. Surveys have been made and plans are now on file to extend this road 32 miles farther to the west end of the Park at Deal's Gap. Only strong opposition has prevented the additional construction thus far, but there is a possibility that work may begin instead at the Deal's Gap end where a connecting cross-mountain highway already exists.

In general the fire-road network parallels, in the valleys below, the main state-line ridge, with spurs running up the main tributaries. Fire protection is necessary, but serious question may be raised concerning the value of the mileage of fire-road construction completed. Travel by the public is usually barred by gates but these on occasion have been pushed farther back, and one park guard informed me that, so far as a particular road was involved, when the public demand grew strong enough the gate would be removed.

ALONG A HORSE TRAIL

This severely eroded trail leads up Jakes Creek to Blanket Mountain. Photograph by the Author.

The graded horse trail network is in part an extension of the fire-roads, continuing on up the streams to the highest elevations at numerous points across the state-line. These trails also parallel the main ridge both at the lower and middle elevations, and one trail extends along the crest itself from the east boundary of the Park at Davenport Gap to Newfound Gap and the start of the Skyline road.

The foot trails have far less mileage than the graded horse trails. They take off at various points along, or at the terminals of the horse trails, reaching into such primitive and beautiful localities as the Ramsey Prong beyond the Cherry Orchard, Alum

A SCARRED MOUNTAINSIDE

A view of the Skyline Road from a distance, showing the damage it has done. Photograph by James E. Moorhead

Cave to Mt. Le Conte, and into the Three Forks of Raven Fork on the Carolina side.

In addition to the above dug trails are several hundred miles of primitive trail "breshed out" and "trod down" in the days gone by by mountaineers in the course of their pursuits throughout the territory. These are now mostly overgrown, blocked out at dug trail crossings, and in all difficult to find and follow. Yet, such as they are, they are well worth the effort in bringing the hiker to sections of unusual interest. Most of the trails shown on the recent United States Geological Survey maps of the Park are of this type. Many experienced hikers still prefer them because they follow the topography more naturally, are far less tedious to travel, and provide softer and quieter footing than the harsh tread of the dug trails.

Unqualifiedly the promiscuous trail and road construction, especially that of the Skyline highway, has harmed considerably the natural qualities of the Smokies. It is obvious that, in laying out the graded trails, their use for horseback riding, rather than walking, was uppermost in mind. Indeed one stretch was successfully negotiated by a motorcyclist from Newfound Gap! The fact is that the number of hikers has been, and will continue far in excess of the number of riders; that the traditional mode of travel in this region is walking, not riding; and that the unusual climatic conditions and the low porosity of the soil after removal of its organic layer lead to severe erosion of the trails unless they are closely and continuously maintained.

If the mileage of horse trails were limited in proportion to the relative amount of horseback travel, and the mileage of genuine foot trail correspondingly increased, the actual needs of the recreational public would be better served, fewer ugly scars would be visible from afar on otherwise attractive mountainsides, and the beauty of the areas so traversed would be much less marred. There is no valid reason, for example, why Mt. Le Conte, the most dominant peak of the Smokies, should have four separate horse trail routes, and another well up towards its summit to Alum Cave. On the most popular route, from Cherokee Orchard up Le Conte Creek to Rainbow Falls and thence up Rocky Spur, a favorite for hikers, horse travel has already widened the path, muddied it up in many places to at least ankle depth, and detracted from the satisfaction the more numerous hikers might otherwise gain from the scenery along this route. Certainly one well-maintained horse trail would have been sufficient.

Apart from the damage caused by unjustified and ill-planned trails is that done to the native cover and soil as a direct result of careless construction. Few horse trails exist in the Park today that are free from uprooted marginal trees of all sizes, the drying out of marginal vegetation, thereby increasing the fire hazard, and accelerated water erosion. The Boulevard trail is a case in point. This runs from Newfound Gap to Mt. Le Conte via the Boulevard, a steep, knifelike ridge along the crest and slope of which the trail is hung. Throughout its entire course the trail is above the 5000-foot elevation, and is entirely in the spruce-fir type. The soil along the ridge and slope is very thin or gives way entirely to layers of loose slate. My first trip over this route was shortly after its construction. Dynamite had been freely used to make a trail "wide enough" for horsemen; it was also found necessary to cut the roots of adjacent trees on the trailward side, evidently to prevent stumbling. New as the trail was, numerous trees so weakened had already fallen. My surmise that many others would soon follow, especially in view of the winds

ONE OF THE ROAD'S BY-PRODUCTS

Windthrow along the Skyline Road. The trees tend to fall in clumps in the fashion shown here. Photograph by James E. Moorhead

prevailing in this section, was borne out by a later trip. This is by no means an isolated case. Exactly the same thing has happened in many other places; along the state-line between Inadu Knob and White Rock, and along the two trails from Cosby to the state-line, to give a few instances.

These same trails and others, such as the Blanket Mountain, Porters Flat, Greenbrier Pinnacle and Rocky Spur routes have also been subjected to erosion, and bad washing has occurred in many places.

Considering all the factors I submit that trails of a maximum width of 18-inch tread would be much simpler to build, more easily fitted to the topography, much less destructive to the landscape, and far more enjoyable to the pedestrian—yes, and to the occasional horseman too—than the "celluloid" variety. Moreover the cost of maintenance, no small item, would be considerably less.

SCENES ALONG THE TRAILS IN SMOKY MOUNTAIN PARK

At left, damage along the horse trail between Mt. Guyot and Inadu Knob caused by cutting of the roots of a fallen tree below the trail. Below, uprooted spruce on graded horse trail between Inadu Knob and Low Gap. Photographs by the Author

The most vivid example of concentrated destruction to Park features, however, is the Skyline road. Among other effects the construction of this highway has brought about the complete despoliation of Indian Gap, once the most beautiful grassy bald of the Smokies. This despite the fact that the landscape architect, in charge when the road was being planned, on being shown this gap assured members of the Smoky Mountain Hiking Club that the road would be hung below the bald instead of going through it. With the death of Indian Gap went a rare wilderness gem that can never be restored.

The subsequent history of this highway is marked by a long train of destruction, forcing the Park Service to conduct several sizeable logging operations to remove the hundreds of fallen, broken and dead virgin spruce and fir trees along practically the entire right of way. On numerous occasions, from various points in the Park, even as far away as Gregory Bald and from Haw Knob in the Unaka Mountains, on clear days, I have seen from a distance the ugly gash high up near the state-line that marks the Skyline drive.

More detailed observations of the effects of the Skyline upon the surrounding vegetation have been made by myself and others at several times since its completion. The latest and most thorough study was made in March of last year by Mr. George S. Perry, a trained forester and botanist of long experience and accomplishment, and the writer. The predominant timber species throughout this locality are the red spruce and the southern balsam fir, both of which reach the acme of their development in the Smokies. Yellow birch and other hardwoods, though present, occur infrequently and are limited chiefly to the gaps.

A tree-by-tree count was made along five of the seven and a half miles of the drive, selected so as to be fully representative of all types of conditions, to give us an accurate basis for judging the damage to the natural cover.

Only those trees were tallied that have been adversely affected during the preceding eighteen to twenty months, trees overthrown, dried out or broken, and stumps cut prior to that time not being considered.

The five-mile sampling revealed 825 dead trees, 345 uprooted or badly-leaning trees, and 92 recent, undecayed stumps, or a total of 1262. These data, applied to the entire right of way, indicate 1221 dead trees, 511 uprooted, and 136 fresh stumps, or a total of 1868 trees destroyed. The tally by species showed these to be roughly proportional to their distribution in the forest, indicating that the spruce and fir are about equal in the inability to resist wind and desiccation when opened up. Some yellow birches, a minor component of the stand, were also affected. Diameters at breast height of killed and damaged trees ranged from two up to thirty-four inches, but nearly all were well over five inches, the greatest loss by number occurring between five and eight inches. The largest spruce windthrown was nearly three feet in diameter and ninety-four feet in height. When this giant went down it carried with it five others

including a fir fourteen inches through and 65 feet high.

Although our investigation showed no evidence of bark beetles or other insect pests, this danger is always a possibility wherever coniferous trees in large numbers have been injured or weakened.

The most serious, long-run effect of the highway to date is apparently that of modification of soil moisture conditions and the promotion of surface drying by wind and sun. Already xerophytic conditions seem to have developed, as indicated by the appearance of dry-site grasses and other herbaceous species, although it is still too early to judge definitely. Thus, in reality, the Skyline constitutes a wind funnel and drainage ditch, a combination of most dangerous consequences to shallow rooted moist-site species adjusted over a long period to grow in dense stands in interlocking association with their fellows. Of significance, in the fact that both spruce and fir, with some exceptions, are shallow rooting, the Skyline has in places made nearly vertical cuts twenty to forty feet high. These cuts have gone much deeper than the water table along a large part of the route. The extremely heavy rainfall on the day of our last investigation, and in the period preceding, also gave us a good opportunity to observe how the water seeps out from beneath the organic forest floor and loose, rocky or gravelly subsoil where the cuts penetrate these layers. We found the water running everywhere down the road banks and following the road-ditches to the drains, which further aggravate the situation by discharging it to form narrow areas of abnormal moisture below. Between these concentrations probably ninety per cent of the trees are robbed of the subsoil moisture originally supplied. These conditions are sufficient to account for much of the loss that has resulted from the unfortunately-conceived high-speed highway through these rare and marvellous natural evergreen stands.

RESULTS ON THE SKYLINE ROAD

Damage as observed in June, 1936. The forest has since receded considerably. Photographed by James E. Moorhead

In its capacity as a wind funnel the right of way permits the sweeping wind and the sun to desiccate the soil beneath the border trees to a notable extent. This was especially observed by Mr. Perry in a previous study in June, 1936, near the close of a severe drought. Road banks were entirely dry and the organic soil for fifty to a hundred feet on either side was tinder-dry, although farther back into the forest considerable moisture was still present in the fern and moss-covered duff.

This unnatural drying out process makes the spruce and fir unthrifty, weakens their root systems, and renders them all the more liable to increased wind pressure created by the wide opening.

Without attempting to predict just how far back from the road the loss of trees will extend with passing years, it is certain that more thousands of the older and less adaptable trees—the heart of the primeval stand—are destined to go down one by one or to die in place during the next decade. There is some hope for the younger, healthier, less crowded trees, especially those few in mixture with hardwoods, but generally all of the splendid clumps and groups of spruce and fir of pole size and larger are destined to be completely wrecked.

The worst eyesore of the entire stretch was the tangle of fallen timber at the parking place on Forney Ridge. The number of windthrown or broken trees here is proportionally greater than anywhere else. Eighty trees at the time of our count were lost by drying and another hundred from uprooting and breakage. A ridiculous effort has been made to hold up some of the larger spruces with steel guy wires imbedded in concrete blocks. Despite this "precaution" the trees have insisted on dying and breaking anyway. In some cases even the guy wires have broken.

Spruce and fir have been planted on part of the devastated area just above the parking place but here, too, simple ecology has been ignored, since these plants are weak and spindly saplings removed from their shaded setting in the moist forest and planted entirely in the open on the rocky, stony slope! It is highly improbable that more than five per cent will survive, despite mulching of the surface.

Even destructive lumbering does not destroy the growing site so effectively as has the Skyline. This is plainly discernible on an adjacent slope of Forney Ridge, where logging had formerly occurred. Though the timber was removed, sufficient organic cover and soil moisture had been retained to permit the establishment of a now thrifty stand of conifers.

In the light of the utter disregard of the delicate biological balance existing at high altitudes, as evidenced by

the building of this road, the following excerpts from a public address by Secretary of the Interior Harold P. Ickes in February, 1935, before the CCC workers in State Parks are most significant. (These excerpts are taken from the September, 1935 issue of *The Living Wilderness.*)

"I am tremendously interested in parks, particularly in those sections of them which are wilderness. . . . It is easy to destroy a wilderness; it can be done quickly, but it takes Nature a long time . . . to restore for our children what we have ruthlessly destroyed. . . .

"I am not in favor of building any more roads in the National Parks than we have to build, I am not in favor of doing anything that we do not have to do. . . . I do not happen to favor the scarring of a wonderful mountainside just so that we can say we have a skyline drive. It sounds poetical but it may be an atrocity. . . ."

This article sums up to a serious concern over the thinking and motives behind the unfortunate development of the Great Smoky Mountains National Park, and other primeval parks already established or to be created.

I shudder to think of a similar fate befalling the Olympic Mountains. Perhaps I am utterly mistaken, but I have always been under the impression, as one person puts it, that "National Parks are created primarily to preserve outstandingly splendid examples of Nature in a natural condition."

I would like to know if such areas are to be administered with that end in view, or raped and sacrificed to the cult of bigger and better landscaping and highway engineering developments. It would seem as if the types of construction in such places should be of a decidedly different order than would be called for in a city park such as Prospect Park in Brooklyn, New York. While in both cases the aim is presumably to preserve and maintain those remnants of the natural environment still left us, from this point on the similarity vanishes. National Park development not only should be limited in spread but should also conform to the utmost simplicity of treatment of the landscape. Those of us who try to retain an appreciation of the natural in our highly artificial civilization cannot but help deplore the promiscuous application of highly formalized types of construction in areas where obviously entirely different treatment is demanded.

To justify the many more miles of summit-topping speedways advocated by tourist-boosting organizations in the mountainous regions of east Tennessee and western Carolina is to ignore the fact that ample provision for such roads has already been made. The highest and outstanding peaks in that region, Mt. Mitchell, Roan Mt., Mt. Pisgah, Max's Patch, and White Top in southwestern Virginia, are already accessible by automobile, and many others are provided with passable enough roads and horse trails. The same holds true for many of the most attractive waterfalls and gorges. These facts should not have been ignored in laying out the Skyline and the extensive horse trail network in the Smokies. Yet it is all too apparent that these facts were given no consideration; that no attempt seems to have been made to think through a sound program based on such considerations and in harmony with established organic National Park policy.

It is thus with mingled feelings of sadness and concern that I bid farewell to the Smokies. Is my departure to mark only an interlude until a happy return to unspoiled, familiar scenes, or is it to be a last, painful parting from an association that can never be renewed? Only time and an aroused public consciousness can answer.

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Another Trail Marker

As a result of the article on Indian trail markers in the August-September (1938) issue of Nature Magazine, many readers have discovered and reported trees that, in an earlier day, served the Red Man as direction signs just as well as our highway markers serve us today. Louis Zara, Chicago novelist and short story writer, sends us the accompanying picture of an excellent Indian trail marker, being particularly interested in such relics of the past because he is writing an historical novel of the old Northwest.

Bent long ago, when a sapling, to indicate the direction of the trail, this tree is at a cross-roads leading to Port Sheldon, Michigan. A century ago an eastern land company planned to make Port Sheldon the great western terminus of the eastern railroads, Mr. Zara tells us. This project failed, of course, and Chicago, diagonally across the lake, became the terminus instead.

Situated in the dune country, Port Sheldon now has only one or two year-around residents and a small summer population, Mr. Zara being one of the latter group. Knowing about this tree, after reading our article he immediately went out and "shot" it.

Things to Think About

Bearing the title *Idle Lands—Idle Men,* a pamphlet recently published by the Minnesota State Planning Board contains much to inspire thought. Based upon material gathered by the Lake States Forest Experiment Station of the United States Forest Service, this booklet deals with a great area of cut-over, virtually waste land of northeastern Minnesota. Here is a region stripped of its original timber resources, unable to support the remaining residue of population and constituting a serious social and economic problem. It offers a splendid opportunity for planned reconstruction, and there are many other areas in the United States in similar plight. This booklet is worth reading.

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The period March 7 to 14 has been set aside for the observance of Conservation Week in California, in which many Federal and State agencies and California organizations are joined in this educational work. Pearl Chase of Santa Barbara is chairman of the observance, with L. A. Barrett of the Commonwealth Club of San Francisco as associate chairman. The schools, radio, and exhibits will contribute to public education on forest fire prevention, recreation, wildlife and soil conservation and other phases of the broad conservation problem.

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Either the crow population of Indiana is tremendous, Indiana hunters are poor shots, or the crow is too wily, but the State Department of Conservation is embarking on its sixth annual crow-shooting contest. Under this awards are made for the clubs turning in the most crow feet, and more than eight hundred groups are entered. The winning club in 1938 produced 78,849 feet, which gives some idea of the total number of crows that must have been destroyed. However much drastic control of crows in some regions may be necessary, we have yet to see any justification for this wholesale method of control. It is grossly expensive in other forms of wildlife, most of them beneficial—shot by accident or design and never reported. Control, where necessary, should be justified by the facts and conducted under proper supervision.

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In a number of the States—most notably Pennsylvania, Wisconsin, and Michigan—proper handling of an increasing deer population has become a serious problem. In some areas the numbers have become too great for the range—particularly, of course, the winter range. Deer have become a source of considerable economic loss to farmers in other regions. Much argument has resulted among game officials, conservationists and sportsmen as to length of season, bag limits, shooting of does and bucks, and general management of the herds. Anyone interested in deer, from whatever viewpoint, will be interested in a careful discussion of the problem in Michigan contained in a booklet entitled *Whitetails* recently published by the Michigan Department of Conservation at Lansing.

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"The uncontrolled development of state highway roadsides by persons whose property adjoins the road is a private exploitation of a public investment, which results in the serious depreciation of public benefits from that investment." So declares John Yeon, chairman of a subcommittee of the advisory committee on roadside protection in a report to the Oregon State Planning Board. He further asserts that: "In the construction of highways, the public has the right to expect not only adequate facilities for transportation but also the amenities of travel available from proximity to attractive rural landscapes, free from the distraction of flanking developments. Roadside enterprises are usually discordant in appearance and too often completely obscure the countryside beyond. The problem is seriously critical near the approaches to cities where all who leave or enter the community are forced to pass through a blighted area of rural slums. The problem is grimly tragic in regions of great natural beauty where superb landscapes have been impoverished by the mean changes wrought through tawdry developments which intrude upon the vision of all who travel by."

Mr. Yeon has packed a lot of undeniable fact into this one paragraph. No one can deny the unhappy truth of his statement. How long, we wonder, are the American people going to put up with roadside parasites fattening off the billions we have put into highways?

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S. B. Show, regional forester in charge of the California Region of the United States Forest Service, makes a surprisingly and refreshingly blunt statement of the Forest Service attitude on further extension of National Park areas in California. He declares that "The Forest Service will fight any proposed extension of National Parks in California that will lock up National Forest resources vital to the welfare and prosperity of the people and the State." This applies to the proposed Kings River Canyon National Park and any other new Parks. He points out that there are now in California four National Parks and eight National Monuments aggregating more than four million acres. These are closed to economic use and administered solely for recreation, and this, Forester Show avers, should be enough out of any one State. Without going into the relative merits of the Kings River Canyon proposal, we must admit that we find it refreshing to hear a spade called a spade in this rather permanent controversy

about areas between the National Park Service and the Forest Service. In the past it has been a case of honeyed words for public consumption from both sides. Questions like this should be fought out fairly in the open.

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According to a report to the Biological Survey from Frank Dufresne of the Alaska Game Commission, the large brown and grizzly bears of Alaska are holding their own as an outstanding wildlife resource of the Territory. Protection is extended to the bears in sanctuaries established by Executive Order, on National Park and Monument lands, and on areas closed by game law regulations.

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As a contribution to wild flower protection in Wisconsin, the State Conservation Department has issued a booklet called *Wisconsin Wild Flowers.* It is designed for school use, and is a manual and guide covering 126 of the more common wild flowers in the State. Distinction is made between those that should never be picked, those that may be gathered in moderation, and those abundant.

WHALE PROTECTION

For some years the American Society of Mammalogists has joined with other organizations in the protection of whales, a project in which all naturalists should be interested. From the November, 1938, number of the *Journal of Mammalogy,* page 525, we quote the following report of progress:

In the summer of 1937 there was held at London an International Whaling Conference, and it is gratifying that all of the countries attending have either ratified or acceded to the provisions of the agreement reached at that time.

A second International Whaling Conference was held in London from June 14 to 24, 1938, attended by the delegates of 13 countries, including the United States, Great Britain, Norway, Germany and Japan. Remington Kellogg was a delegate from the United States. Additional provisions agreed to, according to the press communique issued by the conference, include the protection in Antarctic waters of humpback whales for a period of one year; establishment of a baleen whale sanctuary in the Antarctic Ocean between Graham's Land and the Ross Sea; and prohibition of pelagic whaling in the Arctic Ocean.

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FIELD TRIALS AND SPORTSMANSHIP

We know little about field trials but had generally assumed them to be sporting events where the best in sportsmanship might be expected to prevail, and where dogs exhibited the ultimate in breeding and training. Now comes a letter and a clipping from one of our members in San Anselmo, California. The clipping is from the San Rafael *Independent* and is a column devoted to a description of field trials held by the Northern California Field Trial Club, of which Clarence J. Pfaffenberger, 1446 15th Avenue, San Francisco, California, is president. Our member suggests that others may be interested to express to Mr. Pfaffenberger their opinion of the practices of his club.

In the report of the trials, Ruth Murgatroyd says that there were many fine dogs entered. Many of the older dogs gave outstanding performances and were a credit to dogdom. But, the writer adds, "for outright stupid cruelty we have seen nothing to exceed the whole setup of the so-called trials." Because the writer's viewpoint is so detached as to belie the usual charge of "sentimentalism," always levelled at those exhibiting an interest in animals for the animals themselves, we reprint the remainder of this report:

For the benefit of those who might not be familiar with this event, the following is the way the affair is handled. First of all a man goes out onto the marsh where the trials are to be held. He has several sticks and a gunny sack containing several live pheasants. These beautiful birds have their feet tied together so that they cannot get away. The man hammers a stake into the ground. Then he takes a bird out of the sack and swings the poor thing around and around his head many times to make the bird dizzy. Then he places it down on the ground beside the stake and goes on a distance and repeats the same performance for as many times as there are dogs to work in that special event. After this has been done the dogs are brought onto the field by their handlers. At this affair every dog seemed to be accompanied by his breeder, owner, handler and one or two photographers, the judge and the "gun," or so-called expert shot, armed with one of the newest and finest in shot guns.

The dog is given his directions by hand motions or whistles and he runs around in the same manner as a child playing that game called "Hot and Cold." When the dog finally scents the bird he has been taught to sit back on his haunches, which is called huffing, until the bird flushes or flies. Some of the birds, in fact, most of them, had been swung around so much that they were unable to get their bearings at all. Several of the birds did not flush at all, then the dogs retrieved them alive, bringing them to their handlers unhurt. But, the part that was so unfair was that these birds, dizzy and with their feet firmly tied together were shot down before they were fifteen feet in the air, in fact several times the dogs became excited and did not obey their training commands to sit and were almost shot by the men shooting at the birds. To make matters worse, several of these "guns" as they are called on the field were such poor shots that they missed the birds entirely and the poor things, with their feet tied together were left to die of starvation on the marsh. They no doubt would get their feet caught in the salicornia growth that covers these marshes.

As if this show were not enough, the next event was held upon the edge of the slough where live pigeons were tossed into the air by hand and then shot down before they fell to the water. The poor things did not have a chance to get their wings straightened out enough to get their balance before they were shot down.

I mentioned the fact that I thought it about the poorest exhibit of sportsmanship that it had ever been my misfortune to witness and a woman standing near me asked: "Why do you feel that way? Didn't you see the trials this forenoon, the pigeons about sat on the ends of the gun and then these wonderful, so-called sportsmen and state's finest gun marksmen could only cripple the poor things. My husband is out there in the middle of the whole thing and he prides himself on being a 'good sport.' I think the whole thing a miserable disgrace." Evidently we were by no means the only ones who were disgusted because a well known Marin man called out, "When are you going to give the birds a chance?" No wonder the good sportsman likes to encourage the building of skeet grounds. Here marksmen can keep in practice but do not have to swing and tie together the feet of pen-raised birds that NEVER HAD A CHANCE!

A Bird in the Hand

By RAY HOLLAND, JR.

WHILE fishing a well-known trout stream not long ago I was given the opportunity to see some very fine flying, as performed by swifts and swallows. There was a hatch of May flies in the air, which served as food for both the birds and the fish. My fluffy artificial fly appeared hopelessly crude as it rode the waves alongside real May flies. The trout were not to be fooled by a man-made article. Yet they were gorging themselves recklessly on the real thing.

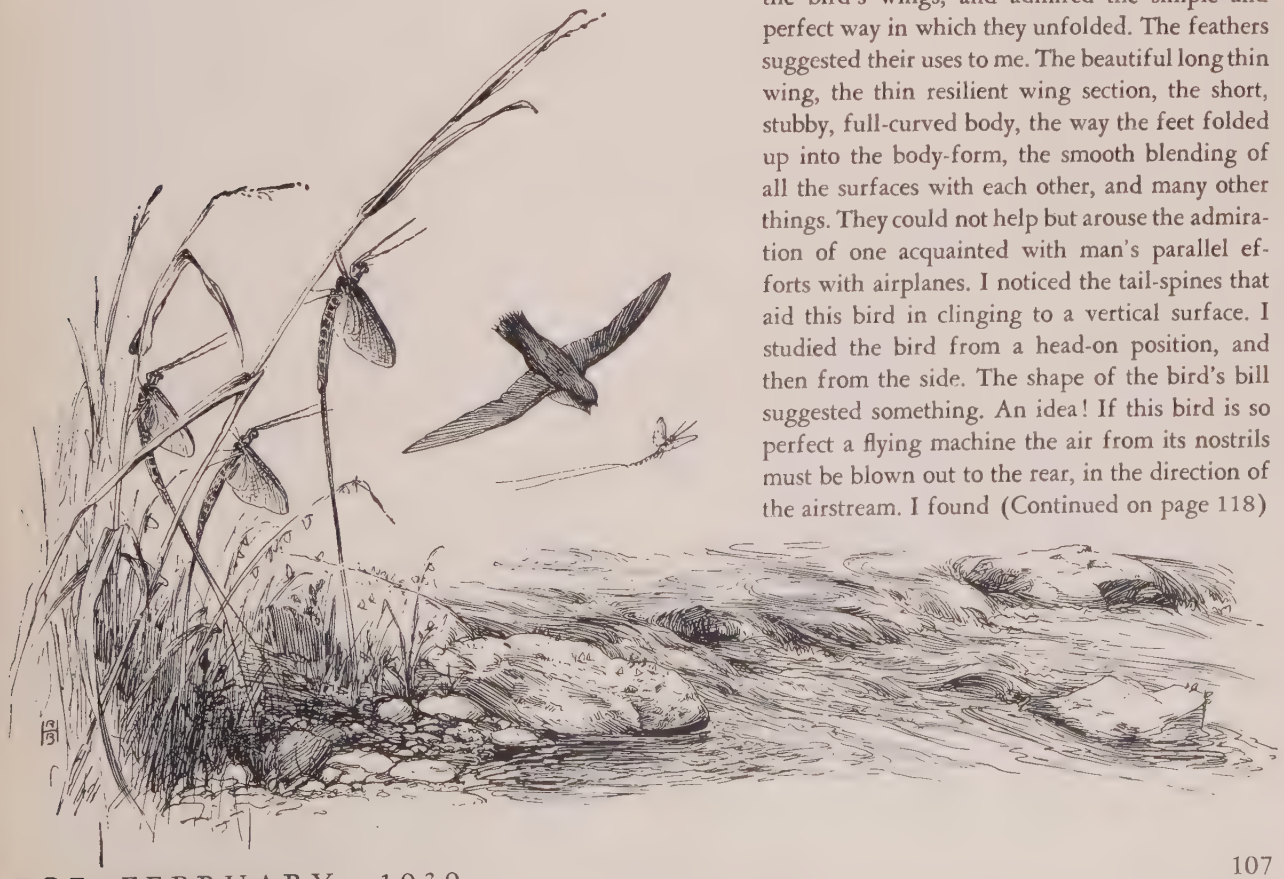
The antics of the swifts and swallows above the tumbling waters of the stream were interesting to watch, and caused me some concern. They flew boldly close to me, not veering until the last second. They are capable acrobatic pilots, these birds that catch flying insects for their living. One of the swifts, in a moment of carelessness, saw my fly as a gust of air caused it to tower and hover like a May fly. I can honestly say that I was not fly-casting for birds, but if I had been I could not have made a more perfect cast for the purpose. The swift veered sharply and before I realized what was happening I had caught the bird on the end of my line! Somehow I had succeeded in spoiling its aim so that it did not get the fly in its mouth. That probably would have been fatal. The leader had struck its wing, and the fly spun around it several times, tying the bird quite securely.

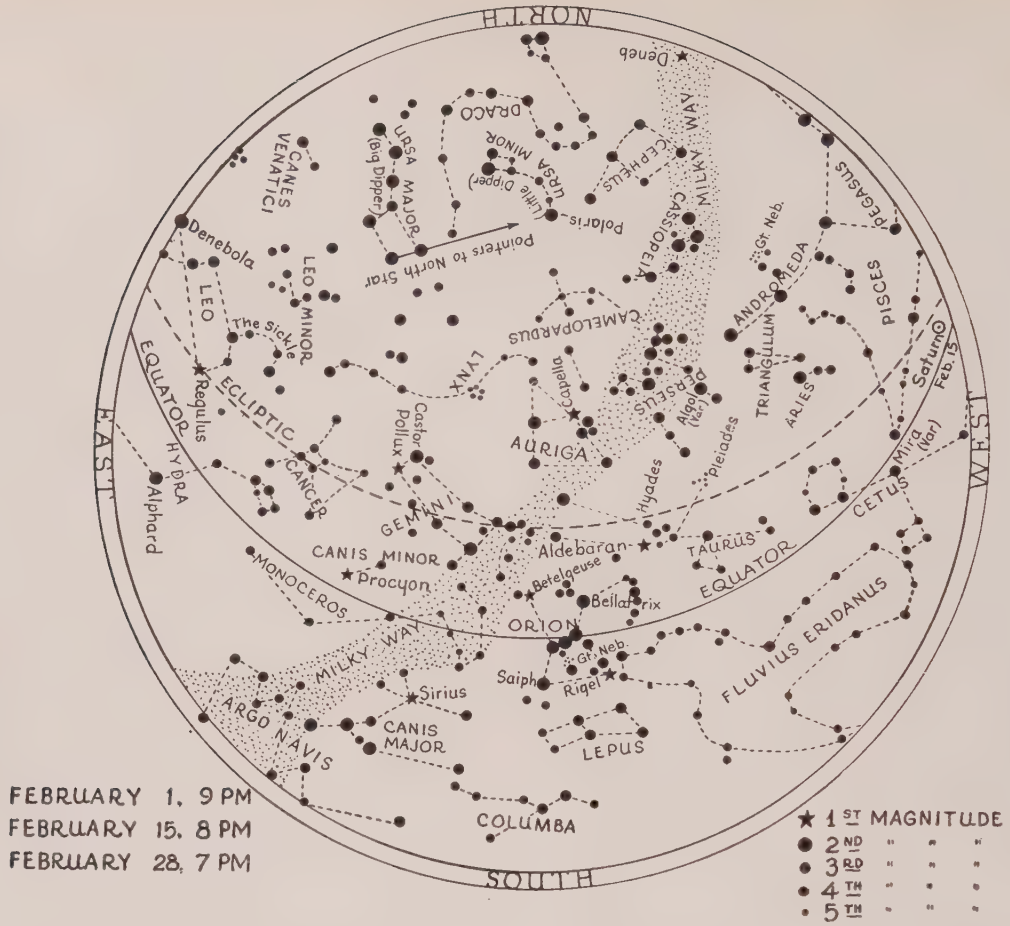
The pull of the line on the swift's wing made flight nearly impossible. The helpless bird fluttered down into the rapid water about fifty feet downstream from me. My first impulse, to try to run directly to it, ended in a good soaking for me, as any trout fisherman will understand. I did succeed in splashing to shore and running down the bank to a point below the bird, which was floating along passively with its wings spread on the surface of the water. I managed to meet it as it came along, scooped it up and hurried for the shore.

I dried it with a handkerchief and held it in a position to drain any water from its mouth and nostrils. There were no signs of life from it. I did my best to dry it, keep it warm, and arrange its feathers. Finally after I thought I had done a fairly good job, I rested it on my knee in the sun. It spread its wings slowly, to my great relief. Then I got a surprise. Off of my knee the bird went, stumbling weakly through the air, down into the stream again!

This second misadventure soaked it even more than the first time. I was able to fish it out again, and this time I carried it well away from the water. Probably I worked with it for twenty minutes the second time with no evidence of life. My first thought was, "Is it breathing?" I pulled a light thread from the ragged edge of my shirt pocket, where I had been sticking my flies, and held the thread above the bird's nostrils. To my disappointment, there was no air motion whatever. I thought that the bird must certainly have been drowned. However, I soon discovered something which is my excuse for recounting this tale.

I felt sad at the thought that such a perfect flying machine as this should meet so sudden and complete an end. The total of man's best efforts have been unequal to making anything that closely compares to it. I spread the bird's wings, and admired the simple and perfect way in which they unfolded. The feathers suggested their uses to me. The beautiful long thin wing, the thin resilient wing section, the short, stubby, full-curved body, the way the feet folded up into the body-form, the smooth blending of all the surfaces with each other, and many other things. They could not help but arouse the admiration of one acquainted with man's parallel efforts with airplanes. I noticed the tail-spines that aid this bird in clinging to a vertical surface. I studied the bird from a head-on position, and then from the side. The shape of the bird's bill suggested something. An idea! If this bird is so perfect a flying machine the air from its nostrils must be blown out to the rear, in the direction of the airstream. I found (Continued on page 118)





To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

IN FEBRUARY SKIES

By ISABEL M. LEWIS

THE CONSTELLATIONS that we always associate with winter are now seen at their best in the early evening. Orion, which is generally considered to be the most magnificent of all the constellations, is now nearly due south, and, following closely on the heels of The Warrior in his nightly stride from eastern to western horizon, are Canis Major and Canis Minor, The Greater Dog and The Lesser Dog, with their brilliant Dog-Stars, Sirius and Procyon. Betelgeuse, in Orion, forms with these two stars a large equilateral triangle, and it also lies near the center of a circle of brilliant stars of the first magnitude. These include, in addition to the Dog-Stars, the brilliant blue-white Rigel; ruddy Aldebaran in Taurus, to the northwest of Orion; Capella in Auriga, due north of Orion, and Pollux in Gemini, northeast of Orion. These constellations with their brilliant stars of first magnitude are ones that everyone should know, and it is at this time of year that they appear as a group to the best advantage.

Those who live in Florida and the Gulf States may also glimpse, at this time of year and for a brief period, the beautiful Canopus in the constellation of Argo Navis, that huge constellation of the Southern Hemisphere. Argo Navis may be looked upon as a single constellation, or as a group of constellations, including Vela, The Sails; Malus, The Mast; Puppis, The Stern; and Carina, The Keel. Canopus, which, next to Sirius, is the brightest star in the heavens, is in Carina and is known also either as Alpha Argus or Alpha Carinae. It is at a distance of more than two hundred light years from the earth and is one of the super giants of the universe, to be classed with such stars as Rigel, Mira, or Omicron Ceri, and Betelgeuse. Sirius, which surpasses Canopus in brightness, owes its splendor to nearness to the solar system and is really only a dwarf star, although larger than our own sun. All these brilliant stars that adorn our winter evening skies are not giants. Procyon also is a dwarf star, brilliant because it is so near. Capella, with a diameter ten times that of the sun, we may put in the giant class, however, and also Aldebaran, which has a diameter about twice as great as Capella, or about twenty times that of the sun.

With these brilliant winter groups identified, it is an easy matter, using them as points of reference, to become

acquainted with some of the less conspicuous but interesting constellations. Cancer, The Crab, is one of the least conspicuous groups of stars in the heavens. It contains no star brighter than the fourth magnitude, but it is of importance because it is one of the twelve constellations of the zodiac, lying along the ecliptic between Gemini and Leo. Its most interesting object is Praesepe, The Bee-hive Cluster, which is faintly visible to the naked eye on a clear night. One needs a low-power eyepiece on a small telescope to see this star cluster to advantage, and it may be well seen with a pair of binoculars. Praesepe lies within the limits of a small quadrilateral formed by four faint stars, known popularly as The Manger. The two brightest of these stars are of the fourth magnitude and are known as Aselli, or The Asses. Praesepe lies midway between and a little to the west of these stars.

Another small constellation, which would probably receive more attention if it were not so close to the magnificent Orion, is Lepus, The Hare. It lies directly beneath the feet of Orion and is easily recognized by its four third magnitude stars grouped in a small quadrilateral. Below Lepus is the small constellation of Columba, The Dove. Its two brightest stars, close together, are also of third magnitude.

Canopus lies a few degrees to the southeast of these two stars, which in our latitudes are not far above the southern horizon at this time of year.

Monoceros, The Unicorn, is an inconspicuous constellation, created, it would seem, merely to fill a gap in the heavens, and lying along the celestial equator between Sirius and Procyon. It contains not a single star brighter than four and a half magnitude, and is noteworthy only for the fact that it lies directly in the path of the Milky Way, which at this time of year extends diagonally across the heavens from Argo Navis on the southeastern horizon through Monoceros, across the feet of Gemini, past the horns of Taurus, through Auriga and Perseus, Cassiopeia and Cepheus, to the northwestern horizon. This is a brilliant and beautiful part of the Milky Way that adds much to the splendor of our mid-winter evening skies. Among the many popular names given to the Milky Way by peoples of many lands that of "The Winter Street," by which it was known to the Scandinavians and others of far northern lands, seems particularly appropriate at this time of year.

Two other constellations that seem not much more than names to us, so inconspicuous are they among their brilliant neighbors, are Camelopardalus or The Camelopard, and Lynx. The first lies between the Pole-Star and Perseus and is one of the circumpolar groups that never sets in far northern latitudes, and the second, running in a long line of faint stars from the Sickle, in Leo, to a point directly north of Auriga, serves to fill the space between these two constellations and north of Gemini and Cancer. All of the space between Lynx and The Pointers of the Big Dipper, and it is considerable in extent, belongs to the huge constellation of Ursa Major and forms part of the head and fore-quarters of the Great Bear. The stars of The Big Dipper outline only the tail and part of the body.

Another small constellation that we might add to our list of little-known winter groups is Leo Minor, which we will find directly north of The Sickle in Leo and below stars of third magnitude that belong to Ursa Major. Leo Minor lies also directly east of Lynx, which has but one bright star and that only of third magnitude, found near the boundary between Lynx and Leo Minor.

Those who have become well acquainted with the noted constellations of winter, such as Orion, Taurus with its Pleiades and Hyades, and Auriga, may wish to complete their picture of the northern heavens by filling it in with these more modest little groups scattered here and there among their more illustrious neighbors. A good star atlas is something that everyone who wishes to become skilled in knowledge of the constellations should possess, for on monthly sky maps one cannot show all of the fainter stars, that in many instances serve to outline the less conspicuous constellations, nor the boundaries between constellations, without destroying the purpose for which they are made, which is to present an outstanding picture of the more important and most interesting constellations. Yet amateur astronomers have made some important contributions to astronomy through the discovery, for example, of novas, which was made possible only through a familiarity with all the constellations, great and small, and the positions of all their principal stars. It is surprising how easily this knowledge is attained if one gives it a little time and thought, adding from time to time a new friend among the stars to an ever-increasing list.

In February we find only one planet well placed for observation in the evening sky. Saturn is now in the western evening sky in Pisces, setting after nine P.M. the first of the month. Jupiter is also in the evening sky but is too close to the sun to be seen to advantage this month, although it may be seen low in the southwest after sunset the first of the month. Mercury is too close to the sun to be seen this month. It will be in conjunction with Jupiter on February 26. Venus is now a magnificent morning star just past western elongation the first of the month. Mars also is a brilliant object in the morning sky before sunrise. It is in Scorpio only a few degrees from Antares, whose name means Rival of Mars. Mars is now approaching the earth and increasing slowly in brightness. The middle of February it exactly equals Antares in brightness but surpasses it rapidly in brilliancy after that date.

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Growing plants with nutrient solutions instead of soil, and stimulating plant growth by the use of artificial light are modern developments in horticulture. In fact, they offer to the plant enthusiast an opportunity to experiment, and, perhaps, to discover new ideas and methods. In the March issue C. F. Greeves-Carpenter discusses these off-shoots of conventional gardening in an interesting article entitled "Horticulture Goes Modern"

THE SCHOOL PAGE ★★★

EDITED BY DR. E. LAURENCE PALMER

Professor of Rural Education, Cornell University, and Director of Nature Education, The American Nature Association

Let There Be Light

The study of light and its various aspects in the pre-college years is about as incoherent as any phase of science that is considered at these educational levels. We need some light on the study of light. When, in art, children are taught that red, orange and yellow are warmer than green, blue and violet, any child can, by direct experimentation, demonstrate that the reverse is true. We need light on what is suitable for the different grades in the study of light. Some outlines, for example, propose that the distances in light-years between different units of the universe be presented as low as the third grade. Program after program treats light in great academic detail without suggesting simple introductory experiments that might make the academic generalizations at least partially significant.

For proof that there is little reason or uniformity in the consideration of this subject, let's look at the way a few school programs deal with grade placement of the color aspects of light. Color is given some study in every one of the first six grades in the outlines for Harrisburg, Pennsylvania, (1932); St. Louis (1926), and Minnesota (1928). It is omitted from the sixth grade in New York City (1927); from the first through the sixth in New York State (1933); California (1932); Trenton, New Jersey, (1929), and Summit, New Jersey, (1931). In the Texas (1936) and Florida (1934) outlines it is included in the fifth only; in the Massachusetts (1931) outline, in the second only, and in the Pittsburgh, Pennsylvania (1928) outline in the kindergarten only.

In contrast to the dearth of study of this interesting and easily demonstrated science there has appeared much about extinct dinosaurs, the study of the molecular nature of the universe, the laws of heredity and so on. Still we preach to the highest heavens (even trying to tell how far away they are) that we are trying to develop in our children an understanding of the scientific method.

In the elementary grades, at least, let's try to get down to earth. A few practical suggestions might not be out of order. Maude Schaeffer recently developed a series of interesting experiments in which the heat-absorbing qualities of different colors were demonstrated by placing differently-colored papers and pieces of rubber on snow and measuring how deeply these melted their way into snowbanks when exposed to the sun. She also made an interesting series of experiments showing color changes that take place in various winter twigs, using as color guides the color strips found in the paint sections of various mail-order house catalogs. These commercial colors might or might not be properly named, if checked with standard scales, but for elementary school use they were deemed sufficient. Studies dealing with the ease with which things of different color were lost against different backgrounds were suggested. These things might well lead to the commercial significance of color in determining the market value of fruits, butter, eggs and even of cattle on the hoof. Miss Schaeffer demonstrated that art teachers could not be depended upon to teach color by showing highly recommended drawings of rainbows in which the colors of the spectrum were improperly placed, and others showing primary and secondary rainbows in which the colors in each were arranged identically. She showed that color phenomena play an important part in everyday life; that there are great individual differences in the ability of persons to recognize color. These facts are highly significant and are not now being recognized in elementary school programs. The average elementary text sacrifices these real experiences for the sake of cramming the child's mind with facts that cannot possibly be appreciated.

NATURE MAGAZINE and *Nature on Parade* have many superior pictures showing the significance of light in providing protection for forms of wildlife. The section of the magazine dealing with amateur photography has been rich in simple suggestions for using light satisfactorily in recording things that interest us in Nature. Surely many of these things are more suggestive of elementary school experience than much that is offered in the orthodox outlines.

It cannot be denied that there is a genuine interest in the heavens, and that they must be considered in any studies associated with light. The insert in the center of this number of NATURE MAGAZINE is given as evidence that the philosophy expressed in the early part of this article does not exclude the study of light from astronomical sources. This insert will undoubtedly be of greatest use to adults, as well as to children in the upper elementary and high school grades. Most people interested in stars will already have a planisphere, but, for those who wish, directions for making one appear on page 91. It is hoped that if this model is cut out a copy is first made of the index to the stars that is printed on the back. With that index available one can quickly locate useful data on the major stars and constellations. If one wishes really to locate stars in the heavens a planisphere of some sort is almost indispensable.

The section on "The Sky at Night" does not provide information on the myths associated with the various constellations. Certain city and state outlines might be mentioned that attempt to belittle the study of *Nature,* and set themselves up as guides to the study of *Science.* Yet their proposals for star study are almost solely those dealing with the myths about stars. The writer feels that while myths have their place, the study of the facts is even more interesting if a suitable guide is available.

If a user of this section of the magazine wishes to study things in Nature that are a challenge to his scientific imagination let him read here about Polaris; about Star 29 in Orion; about Star 6 in Andromeda, the great spiral nebula; about Kochab in the lip of the Little Dipper or Ursa Minor; about Thuban in Draco; about Alcyone in The Pleiades; Sirius in Canis Major; Star 5, or the Runaway Star, in Ursa Major; Regulus in Leo Minor; Stars 2 and 7 in Canes Venatici, and by all means about Antares in Scorpio. The figures necessary for a reasonable discussion of these stars are such that their consideration may even make those pessimistic about the national debt forget their worries temporarily. Unfortunately a further study of these stars brings out the fact that it is difficult to imagine that there is anything comparable to our solar system elsewhere in the universe to which those dissatisfied with conditions on the earth could escape.

Profitable mental gymnastics may be associated with getting a reasonable idea about what is meant by such terms as magnitude, variable, period, light-year, which of necessity are used in the discussion of the stars shown. Other studies that might interest inquisitive amateur astronomers might center on trying to recognize different colors that come from different stars. The white light of Spica; the blue-white of Rigel; the ruby star in the cluster designated as Star 23 in Monoceros; the topaz color of Procyon, are a few suggestions along this line. Let some interested student complete this list and check his observations.

Probably the relationship between distance and the speed of light is most likely to stagger those who are incredulous. The story of Star 7 in Canes Venatici is one that could readily provide a test of the confidence one might have in the authority of astronomers.

Since light and heat are closely associated, a study of Procyon might interest some, and if that warm star seems to be too near for comfort, even in the dead of winter, find out what the conditions are on Sirius, which happens to be even nearer and considerably hotter. And while this study is going on it might be well to find at what time of the year this "scorcher" is visible during the early hours of the night. If one gets experience in using the planisphere it can easily be demonstrated at what time this or any other star may be seen. Of course one should be sure not to give the impression that the temperature of these relatively near stars has any appreciable effect on the temperature of our earth at different seasons of the year.

A further enrichment of some of the suggestions given on this page may be found in *Nature Magazine's Guide to Science Teaching* on page 17. This is an index to other pages dealing with the subject, and, indirectly, an index to articles in back numbers of the Magazine. It is not necessary that the material there given be repeated here. The articles by Isabel M. Lewis, which have long been featured in the magazine, should be used for further enrichment of the study of light and of astronomical bodies.

A few suggestions, taken at random from some of these sources, and which should enrich teaching about light at pre-college levels, might include practice in studying illumination; time of day; pattern; color filtering; seasonal light variation; light and health relationships; chemical action as a source of light; light absorption by different materials; light production by different means; tricks of photographing subjects variously lighted; equipment for carrying on experiments with

(Continued on page 118)

LOOKING FORWARD

Bathtub Begonias

Well, not exactly that, although you could use a bathtub to grow flowers without soil. Amateurs and scientists are finding new facts about growing things with nutrient salts and by the use of artificial light. C. F. Greeves-Carpenter writes about this in the March issue under the title "Horticulture Goes Modern".

Bucks of the Veld

Diana Mallet-Veale is an artist living in South Africa. One day, with her husband, a pioneer in Rhodesia, she bought at an auction an odd lot of pictures. She wanted the frames but found in ten of them delightful original pen and ink drawings of the beautiful bucks of the South African veld. These, with a story about the animals, appear next month.

Hunting With Pliers

Frank Dunn is a ruthless hunter of game and has bagged monkeys, eagles, giraffes, antelopes and many other forms with no greater weapon than a pair of pliers. What Mr. Dunn hunts are roots and gnarled bits of stumps that Nature, time and weather have made into marvelous bits of sculpture. Read about it next month.

And, In Addition,

We welcome back to our pages, after too long an absence, E. Chesley Allen, Nova Scotia Nature writer; Henry Collins, authority on erosion, and others. Of course there is the Rotogravure Section, the regular astronomy, microscope, dog and photograph departments and other features.

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Peattie and Aymar

Donald Culross Peattie and Gordon Aymar have collaborated in the production of a beautiful book entitled *This is Living*. In it we discover a unique approach to the drama of life; a presentation, largely pictorial, of the components of earthly existence. For many months Mr. Aymar has been assembling, sorting and fitting pictures into his and Mr. Peattie's plan. The authors have divided their book into eight parts with the provocative titles—Life-Force, Young Beginnings, Home, Living Together, Hunger, Mysterious Ways, Death, and Life the Conqueror. To each section Mr. Peattie writes a preface setting the stage for the pictures that follow, and for which he has supplied captions. Mr. Aymar not only gathered the pictures but designed the book, and may well be proud of it. The publishers are Dodd, Mead and Company and the price is four dollars.

Technical Writing

Answering needs of many workers for a proper mastery of the English language if they are to write for publication clearly and effectively, the Extension Division of the University of Wisconsin, at Madison, is offering a home-study course in Composition of Technical Papers, available to individuals in any state. This course, one of a large number taught through correspondence instruction, is described as a helpful means of acquiring excellence in writing under guidance, without interruption to the daily occupation.

SPIDER AND WASP

by C. E. Good

In the early coolness of a summer Sunday morning, a drama of Nature chose for its setting a quiet corner of my back yard, and across the webbed stage a small gray spider captured and killed a wasp of slender body and fighting spirit.

The web hung in the corner of a window opening and in the flimsy network the wasp's four front legs were entangled when I came upon the spectacle. The wasp labored desperately in a violent effort to free itself with its wings. As it whirled round and round the tiny web threads twisted into one larger single thread, by which the wasp was now suspended just below the main network—feet upward. The wasp tried to pry itself loose by bending the rear portion of its body forward and under the legs that were held bound together. It then tried to bite the thread that held so securely.

After a courageous struggle the wasp grew tired and stopped to rest its tired wings. But time after time the waiting watchful spider rushed down upon its captive and touched the wasp with its front leg and the struggle began again. The spider gave its victim no time to regain strength.

The struggle was over. The wasp of slender body and fluttering wings was dead.

The spider began its routine of fastening the wasp more securely. It raced down to its victim, turned around and with its two hind legs touched the extreme end of its body and picked up a silken thread with each hind leg, fastened it to the wasp's wings and then ran to the top of the web where it was fastened again. This was repeated over and over. The wasp was firmly bound before the spider began its juicy Sunday morning breakfast.

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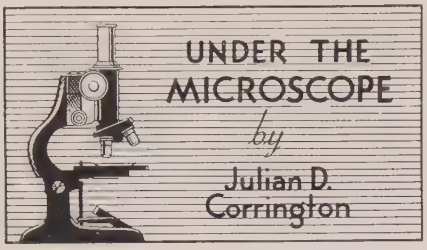


Microtomes

When, in the course of microscopic events, it becomes necessary or desirable to study the structure of thick and opaque objects, sectioning is in order. We can mount small, thin or transparent materials, such as protozoa, moss leaves or paper for observation by transmitted light, or we can arrange the illumination so as to scan the surface features of coins, insect eggs or seeds by reflected light. But if one is concerned with the microscopic anatomy of the higher plant or animal, he must make thin slices of organs like stem or leaf, heart or liver, and prepare these sections for study by transmitted light.

The simplest and oldest method for this purpose is known as free-hand sectioning, an art largely lost with the advent of machine methods, but one which should be mastered by every person wishing to qualify as a microscopist. The old-fashioned razor may be used, as here illustrated, or the safety-razor blade in a folding holder. Since new blades may be inserted whenever old ones become dull, the tedium of stropping and honing can in this way be eliminated.

Young roots and stems, before they become too woody, make excellent practice objects to learn free-hand sectioning. Hold such a stem in the left hand, as shown in an accompanying illustration, the razor in the right hand. The blade lies flat on the base of the left fore-finger, which serves as a guide, the edge toward the operator. The motion of cutting is that of paring, not that of whittling, the blade being pulled toward the right thumb by contracting the muscles of the right fist.

Also the motion should be sliding, allowing the heel or base of the razor blade to enter the stem first, the toe or apex coming out last; a long slicing cut traveling a part of the length of the blade and thus avoiding crushing of the tissue. As Professor Chamberlain remarks, in his manual for plant histology, anyone who is in danger of cutting himself during the various stages of sectioning is in need of the practice to acquire a bit of manual dexterity.

Sections are cut wet. Dip stem and razor blade in a bowl of water between each slice, at the same time floating the previous section from the blade without touching with the hands. Practice until very thin and *uniformly thin* sections are obtained, and avoid wedges, thicker in one part than another. Mount one of the thinnest and best of your sections on a blank slide in a drop or two of water and add a cover glass. This is, of course, only a temporary mount for immediate study and will not keep. Staining with dilute iodine or mercurochrome for one or two minutes, then washing out excess stain with water, will improve such a section for observation of detail.

The free-hand method has its uses, but sections are never entirely uniform, nor are they sufficiently thin in most cases. Many objects are too small, soft or fragile to cut in this manner. During the nineteenth century technicians developed various types of apparatus to supplant free-hand procedure and these received the name of *microtome,* and the science of their operation came to be known as *microtomy.* The meat-slicing machine of your neighborhood butcher shop is an example, and a finely precise microtome of the histology laboratory has been dubbed a "glorified meat-slicer."

There are a number of designs on the market, each with an assortment of advantages and drawbacks. Most generally in use in college laboratories is the Minot Precision Automatic Rotary Paraffin Microtome, to give the full title, designed by Professor Minot of Harvard, capable of cutting sections as thin as one micron (0.000039 inch), operated by means of a heavy rotating wheel, and using paraffin as an *imbedding medium* to support and reinforce tissues while these are being cut.

USING A PROFESSIONAL PARAFFIN MICROTOME. NOTE HOW THE SECTIONS COME OFF IN A RIBBON

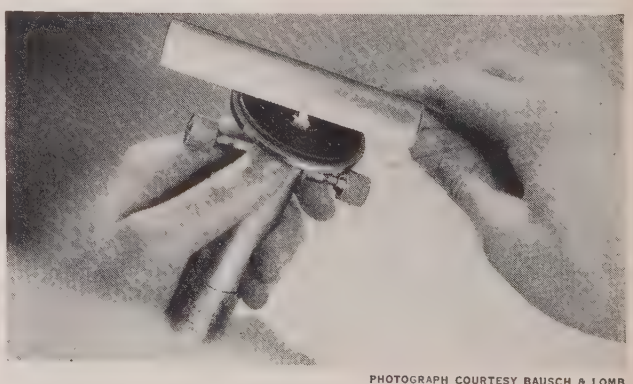
Heat must be employed to melt the paraffin in this method and sometimes that factor must be avoided. Tissues which would be injured by heat, and very delicate, very large and very brittle materials, are often by preference imbedded in celloidin (trinitrocellulose), and cut on a Sliding or Sledge type of Microtome. Each section must be cut separately and while wet with alcohol, the operation being slow and messy. Most technicians prefer the paraffin method wherever possible, as the sections are run off as a continuous ribbon and are cut dry.

Hospitals often need to have sections cut without long preliminaries of fixing, hardening and imbedding, and for temporary examination only. If the brain of a supposed mad dog, for example, is to be sectioned in order to search for evidences of rabies while a victim of this dog's bite is awaiting treatment, speed is urgent. In such a case a Freezing Microtome is employed, the tissues frozen in a sugar syrup by the release of carbon dioxide from a tank such as is supplied to soda fountains, and cut rapidly by a knife operated like a carpenter's plane.

Machine microtomes are expensive and their manipulation usually requires some supervision at first, such as one would receive in a college course in histology or microtechnique. Hence these methods are beyond both the skill and the purse of the average amateur. However, we have known quite a number of ardent enthusiasts who saved up for either a new or second-hand microtome, and mastered the operation by sheer perseverance.

For most purposes the amateur microscopist wishes but a few slides of any given subject and finds that a simpler form, the Hand or Well Microtome, is entirely adequate. This type may be purchased from any of the leading optical manufacturers, or constructed at home by those having a bent in this direction. The principle is to have a perfectly flat, smooth and true cutting surface at the top of a tube, called the well. Tissues are placed in the well and the razor is guided across the smooth cutting surface, slicing off anything that protrudes from the well. If thin and uniform sections are to be obtained, some method of raising tissues from the bottom of the well for a small but regulated amount for each slice is necessary, and the principle of the screw at once suggests itself. In fact, a very crude sort of appliance may be constructed from a bolt and nut of large size, the threads as fine as can be obtained. Grind down one surface of the nut until perfectly smooth and flat, insert the bolt to the smallest degree possible, then fill the well thus made with the tissue to be cut. After each slice give the bolt a twist of a definite amount—say one-

THE FREE-HAND SECTIONING METHOD



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half of a revolution—and slice again. All homemade microtomes are refinements of this sort, and professional Hand Microtomes, as shown in an illustration, have merely the elaboration of finely machined parts, accurate screw fittings and polished surfaces.

Animal tissues are generally surrounded with some reinforcing material, such as hardened beef liver (hardened for several days in

HOW A WELL-CUT SECTION SHOULD LOOK AFTER STAINING. CLOVER ROOT SLIDE FROM WARD'S

10% formalin or 95% alcohol), pith, raw carrot or turnip, strips and wedges of which are packed into the well along with the object to be cut, all materials reaching to the bottom of the well so as to be pushed up uniformly and together by the screw. Pack tightly, then cut all parts together; the tissues thereafter are readily separated from the reinforcing materials.

Imbedding in paraffin is much to be preferred, however, and we recommend that you try this method according to the following schedule: from any freshly-killed animal remove a small strip of muscle, measuring not over one-quarter inch in diameter by one-half inch in length and place in a glass vessel containing about 25 cc of 10% formalin. Leave for overnight, then wash the tissue in water for the same number of hours it was fixed in formalin, either changing the water at intervals or rigging up a delivery for a very gentle stream of running water. Pass the muscle next through a series of alcohols of successively increasing strength; 50%, 70%, 83% and 95%, one-half hour in each, and then into either absolute alcohol for one-half hour or carbol-xylol for one hour, followed in either case by pure xylol for one hour.

Have some melted paraffin at hand. Use a low heat, as from a nearby electric bulb, and do not let the paraffin become hot—it should be kept just above the melting point and no more. The tissue goes now to equal parts of xylol and melted paraffin for one hour, and then into a bath of melted paraffin alone for two hours. One handy method for this paraffin bath is to use a small vessel of almost any nature and place it under a flexible neck student lamp. By raising or lowering the bulb one can soon determine just the point where the paraffin will be kept fluid but will not be overheated.

Finally, warm the microtome and fill the well with fresh melted paraffin, transfer the muscle to the well and orient it in the paraffin so that sections may be cut either lengthwise (longisections) or straight across (cross or transverse sections), avoiding oblique sections, which are difficult to study. As soon as a film has formed over the cooling paraffin at the surface of the well, plunge the whole apparatus into cold water so that the paraffin will solidify quickly; otherwise it is apt to crystallize. When cold, sections may be cut at once or at any convenient later time.

Space does not permit description in this issue of subsequent treatment, which includes mounting the sections on slides, removing the paraffin, staining, dehydrating, clearing, and mounting in balsam. All of that is another story, and will have to be deferred until next month.

Famous Clubs

From time to time in this department we look forward to the pleasure of introducing our readers to some of the outstanding organizations of microscopists, professional and amateur, throughout the world. One of the best known in this country is the New York Microscopical Society, described in the October, 1938, issue.

In England, where the amateur takes his work much more earnestly than on our side of the Atlantic, one of the most notable organizations is the *Quekett Microscopical Club* of London. This society traces back to Feb-

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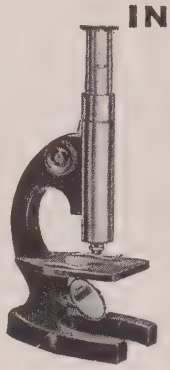

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ruary 6, 1860, with the inauguration of a series of classes on systematic botany given by M. C. Cooke at the Trinity District Schools, Lambeth, which led in 1863 to the formation of the Society of Amateur Botanists. On August 4, 1865, a small group of naturalists in this Society, with Mr. Cooke as chairman, considered the establishment of a microscopical club desirable and so came the Quekett Club, named to commemorate the work of John Thomas Quekett (1815-1861), Professor of Histology of the Royal College of Surgeons, who did much to promote the study of microscopy among both medical men and lay amateurs, among the latter being the Prince Consort who came to the Professor for instruction.

The Club meets at 11 Chandos Street, Cavendish Square, twice monthly, the first meeting devoted to the reading of papers, the second to demonstrations covering every aspect of microscopical research and technique. The *Journal* is published three times yearly under the editorship of W. P. Sollis, and contains the minutes of meetings, reports on papers and briefer contributions by members. Outstanding demonstrations given on the "Gossip Nights" are also recorded.

Once annually, about the middle of October, the Club holds a *Conversazione* and on the last three occasions this has taken place, with its permission at the Royal Society's establishment at Burlington House, Piccadilly. The number of microscopes shown averages two hundred and the visitors eight hundred. Saturday afternoon excursions are held during the summer months when visits are paid to localities where living materials are known to abound. Novices are made particularly welcome at these meetings and soon acquire professional skill under the guidance of the older and more experienced members.

The roll of Presidents includes such distinguished names as T. H. Huxley, W. B. Carpenter, W. H. Dallinger, E. Lankester and E. M. Nelson, while contributions of members have been many and distinguished. Frank Kitton, an early member, is well known for his work on diatoms; C. F. Rousselet became famous as a mounter and an authority on rotifers; D. Bryce supplied the article on Rotifera in the Encyclopædia Britannica; Frederick Enock became outstanding as a mounter of insects and spiders; Earland made a place for himself among the front rank of authorities on the Foraminifera; D. J. Scourfield achieved fame as an expert with the Entomostraca; and finally, E. M. Nelson, who "taught the world how to use the microscope" and who died on July 20, 1938, at the ripe age of 87, added luster to the history of the Club of which he was President for three years, 1893-4-5, and a member for 62 years.

Officers for 1938 were: President, W. E. Watson Baker, F.L.S., F.R.M.S. Vice-Presidents, H. G. Brown, M.I.E.E., J. T. Holder, F.R.M.S., Chetwynd Palmer, F.R.M.S., and D. J. Scourfield, F.L.S., F.R.M.S. Treasurer, C. L. Odam, F.R.M.S. Secretary, W. S. Wharton, F.R.M.S.

National Society

As we go to press, questionnaires continue to trickle in slowly, the total number still small. A decision will be reached in time for the March issue as to whether we shall organize or drop the proposition entirely, and full details will be given at that time.

Photomike Contest

The prize award this month went to Dr. Edward C. Day, 1648 San Anselmo Ave., San Anselmo, Calif.

Second place was awarded Edward T. Richardson, Jr., South Portland, Me., for a very fine photomicrograph of the crustacean *Gammarus*.

The winning photograph for this month, reproduced herewith, is a most unusual study of a commonplace microscopic object—none other than the oft-pictured flea. However, this illustration was made with a hand lens instead of a microscope of the expected type, and by means of reflected and not transmitted light. The result will be interesting for comparison with our picture of a flea by transmitted light in the November issue. Both are the dog flea. Dr. Day's picture shows the eggs as well and was made with a Spencer 10X lens on portrait panchromatic film and enlarged.

The artist used a diaphragm of black paper with a 3 mm. hole in the center to act as a diaphragm and give depth of focus and definition. A gray background was employed plus a white card as a reflector to brighten shadows. Exposure 20 seconds. This will give readers an idea of the almost limitless possibilities when microscope weds camera.

Advanced Hints

Several requests have come in from readers to explain the *dioxan technique*. While it is true that this relatively new reagent has many advantages, we feel it unwise to recommend dioxan to the average amateur for reasons that will become apparent in the following quotation from Lee's *Vade-Mecum* (reviewed in the preceding issue).

"Dioxan (Di-ethylene oxide, M.P. 11°, B.P. 101°) has come into use in many laboratories. This liquid is a remarkable solvent. It mixes with water, alcohol, and xylol, and dissolves balsam and paraffin wax. It is a *dangerous substance* (italics ours), and has a marked physiological and cumulative action. It is unsuitable for students' laboratories, and should be used only for special work. Its advantages are not so considerable that they outweigh the fact that it will affect the health of laboratory workers. Since it has little odor, it is possible for one to breathe toxic proportions in air without knowing it. It is particularly dangerous in those small, improperly ventilated rooms so often used for imbedding and section cutting."

Dioxan cuts out many steps in routine microtechnique and thus saves both time and materials. With many fixers, such as Bouin's or formalin, one can pass the tissues directly from the fixer into dioxan, which will dehydrate, harden and clear, all within a short time, perhaps in twenty-four hours. The dioxan should be changed three times, and graduated steps are even better, such as half water and half dioxan for the first bath, pure dioxan for the second, and half dioxan and half melted paraffin for the third.

Trade Notes

Catalog-of-the-month for February is Bausch & Lomb's *Microscope Accessories*, a fine and beautifully illustrated publication of 48 pages. Here are described, illustrated and priced various styles and types of microscope objectives and eyepieces, and special forms of the latter including demonstration, comparison, erecting and other eyepieces, monocular and binocular eyepiece holders, condensers, camera lucidas, nosepieces, mechanical stages, micrometers, counting chambers, hæmacytometers, slides, cover glasses and other accessories. Drop a line to Julian D. Corrington, NATURE MAGAZINE, and enclose a three-cent stamp to receive your copy.

* * *

Only one more month and the collecting season for frog eggs will again be with us. Are you interested in the science of Embryology? This, to be sure, is an advanced subject and one not to be undertaken in any detail by those who do not have a good foundation in modern biology. For such of our readers as can read technical literature of this sort with profit, we recommend Robert S. McEwen's *Textbook of Vertebrate Embryology*, a comprehensive volume of 581 pages and 270 illustrations, dealing with development of the frog, chick and pig in full detail. It is a widely-used and well-known college text and might well represent embryology on the book shelves of all advanced microscopists. Henry Holt & Co., 257 Fourth Ave., New York City. $4.75.

* * *

In connection with the rotogravure feature this month on the history of the microscope, we have received for review a volume that will be welcomed by all who are interested in following up this historical sketch. It is entitled *Origin and Development of the Microscope*, with the subtitle continuing "as illustrated by catalogues of the instruments and accessories, in the collections of the Royal Microscopical Society, together with bibliographies of original authorities, with 30 plates and 36 text-figures." Published by the Royal Society in 1928, the original price was 17s. 6d., but it may now be obtained from W. Watson & Sons, Ltd., 313, High Holborn, London, W. C. 1, England, for the greatly reduced sum of 5s. Your banker will give you foreign exchange at the current rate so that you can send an order direct to Watson's if you are interested.

* * *

Under the Microscope is a department of NATURE MAGAZINE designed for those readers interested in microscopy and maintains a service to render assistance with problems in this field. You are invited to take advantage of this service. Address all inquiries to Julian D. Corrington, NATURE MAGAZINE, 1214 Sixteenth St., Washington, D. C.

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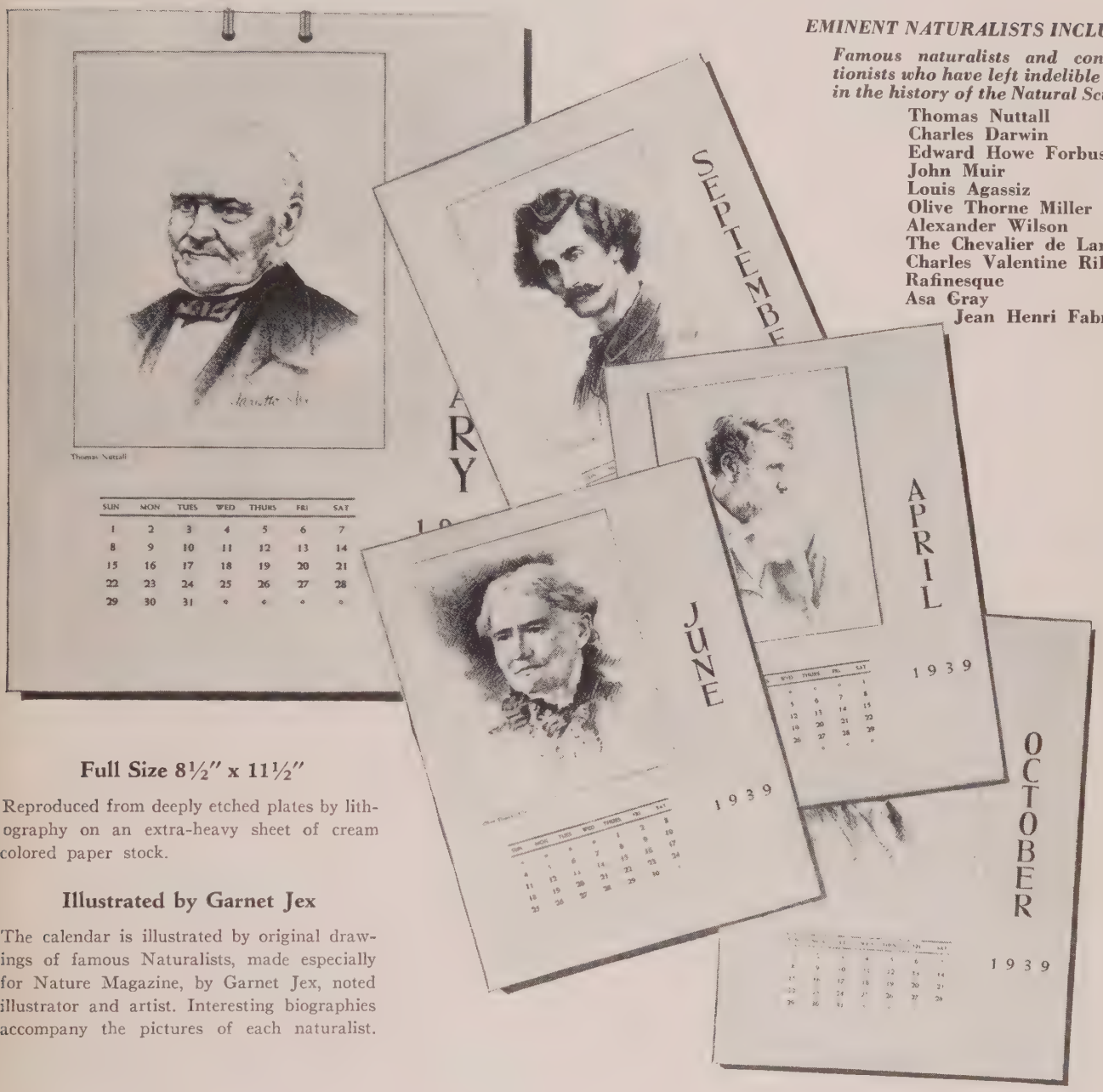

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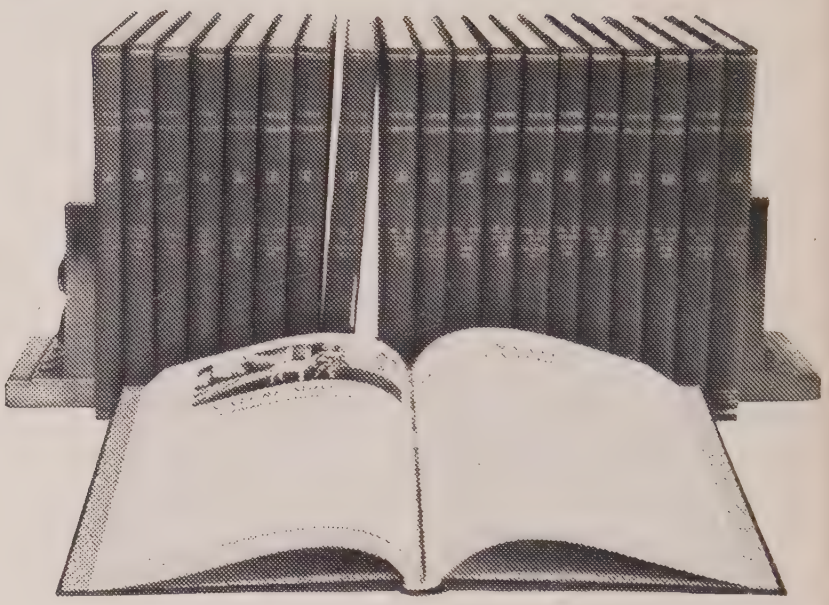

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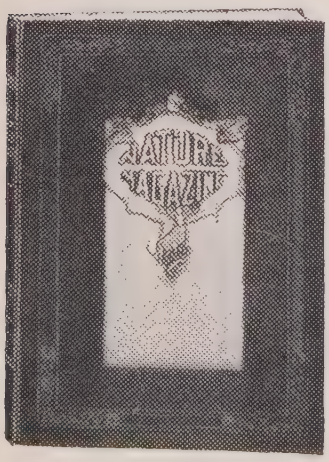

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Diane Morgan's

DOG COLUMN

MORE ABOUT TRAINING

SOME BREEDS are easier to train than others. The French poodle, for instance, is an exceptionally apt pupil, a fact that accounts for his long history as a circus performer. So, also, is the smooth fox terrier, a type rapidly disappearing in favor of the wire-haired.

While it is true that some breeds offer better opportunities for elaborate training than do others, I have found that more depends on the individual dog than on the breed. There are inept poodles as well as wise ones. There are wise Irish terriers, as well as stupid ones!

The German shepherd has proved an easily trainable dog. For this and other obvious reasons these dogs have been selected as the best for police work, war-intelligence work, blind-leading and other important uses.

But almost any dog can be trained to have good manners. To give up in despair or in disgust in the early stages of your canine kindergarten, and to decide that Fido, Fritz or Bozo is "just a hopeless mutt", is really to confess that *you* are a failure.

With a dog, always be of single mind. Don't forget what you have told him. Never confuse him. Remember that his is a dog's mind—simple and primitive. Don't allow him privileges one minute and forbid them the next. The human child can argue with you and point out your error—the dog-child cannot. If you let him sit on the couch or chair once, don't be surprised if you find him there again. He can understand the significance of "never", but not of "seldom".

A dog's place is on the mat beside his master. Sometimes, if you like, on the master's knees, but *not* on the master's chair or in his bed. It is, of course, a good policy to let a dog have an old chair of his own, tagged for him, understood by him as *his,* and not used by anybody else. The floor is a draughty place and the dog is no more fond of draughts than you are. Furthermore, the dog appreciates a cushioned resting place as much as you do.

Don't be rough when you play with your dog. At least, not so rough as to hurt him. That isn't funny to him! You are his god. Don't disillusion him. If you can't keep your own illusions, help the dog to keep his!

In training a dog in a family, only one person should be apparent to the dog as the responsible owner or commander. Your dog will obey the same command from each individual *provided* he has first received it and learned the meaning of it from one certain person.

Do not chase your dog if he playfully runs away. Any dog will come if called, but the master must not be chasing him. To chase him is to make him run farther and faster. If you live in the country, it's a capital thing to train the dog to the whistle!

Only a few dogs, probably, can become such paragons as one recently given much publicity. This fellow opened windows and doors; closed, bolted and locked them; fetched the mail; carried groceries; guarded babies; foster-mothered (Continued on page 118)

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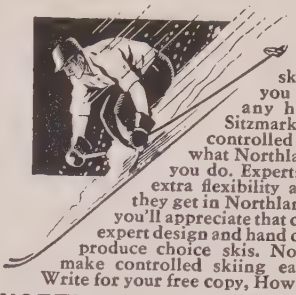

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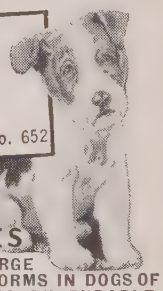

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MORE ABOUT TRAINING

(Continued from page 117)

rabbits; unhooked the telephone and barked into it. In fact, seemed to do everything but hold down a job in an office!

However, I myself have never found the limit to which I could train my dog except to the point of speaking or writing!

Always remember that the dog is thinking more about you than you are about him. Nine-tenths of his waking life is spent in wondering whether you are pleased, and in trying to please you. The other tenth is with his natural desires.

•

A BIRD IN THE HAND

(Continued from page 107)

another piece of lint, and held it behind the bird's nostrils instead of above them. Sure enough, it was alive and breathing! It was breathing in a way that I had never suspected, but in a way which was perfect from the point of view of good streamlining. Nature does not forget such things.

Wrapping the bird in a handkerchief, I placed it in a warm nest on top of the motor block of the car. After about half an hour I removed it, and stroked it. It stretched its wings. Rocking it up and down a few times I released it, and it flew away, perhaps to tell its brothers and sisters of all the wonderful adventures it had had.

This little swift taught me quite an object lesson in the importance of details in good airplane design. The practical interpretation was that the exhaust stacks from the airplane's engine should not open to the side of the plane, but they should face to the rear so as not to interfere with the airflow along the body. Any engineer will agree that this is correct, other factors being equal. But quite often we do things incorrectly for years and years, when we ought to know better, simply because we have never considered doing differently.

This is not the first example, nor will it be the last, of learning about airplanes from the birds. For ages the birds and insects have been an inspiration. But we need not limit ourselves to inspirations. We can obtain valuable working facts. We still have plenty to learn, and a great deal of it may be uncovered by the intelligent observation and study of Nature.

•

THE SCHOOL PAGE

(Continued from page 110)

light at different grade levels, and so on.

It is hoped that no school leader who looks to this page for help will try to teach children in the lower grades the significance of a light-year without preceding it with generous homely experiments with light in the classroom. The light is in the room. Sounds may be made in any room. Gravity acts on anything in the school room. Things vary in their molecular nature in every school room, and yet we find teachers looking for material to teach in the abstruse findings of highly trained technical research workers. These findings have their place in the whole educational picture, of course, but that place is not in the beginning years of the school experience, even though it is often recommended for inclusion there.

INDOORS AND OUT

(Continued from page 63)

the region. But—and perhaps as the compensation that is part of every difficulty—the book has one excellence that is distinguishing. It makes the river a prominent character; no one who reads it need continue to use "Suwannee River" as a meaningless mellifluous phrase. From the viewpoint of the naturalist it is the series' most valuable book so far. As suggested, this may be due to a visitor's keen observation of things that natives take for granted, but it is also attributable to the fact that, though Miss Skinner has announced "the authors of these books will be novelists and poets," she assigned *Suwannee River* to a botanist and gardener.

The river idea is more prominent than the river in *Kennebec, Upper Mississippi,* and *Powder River.* The streams are described by way of introduction, and one is always conscious of the valleys as scenes of human history; the natural history of the rivers is hardly more than suggested. This, of course, can not be called a fault of books that propose to deal with folk ways, not Nature; but *Suwannee River* does show how great a contribution the natural history can be to the total value of the books. The Suwannee rises in the great Okefenokee Swamp, where the U. S. Biological Survey has one of the best of all Federal wildlife refuges, and Mrs. Matschat includes in her section on "Swamp Folk," which comprises about two-thirds of her volume, all that one desires in such a book on the swamp's plant and animal life. She also does justice to the natural scene in her sections on "River Folk" and "Gulf Folk." Perhaps one may be permitted to suggest that authors of future volumes in the series may profit by this example.

Such a suggestion, however, should not be interpreted as a lack of hearty appreciation for an excellent series of books and an eagerness to read the forthcoming volumes. The books include maps and other illustrations. Maitland de Gogorza's illustrations match Mr. Coffin's exuberance with a serenity that also is associated with Maine. Ross Santee's drawings in *Powder River* catch the loneliness and sweep of the West, as well as its action. Woodcuts by David and Lolita Granahan in *Upper Mississippi* and by Alexander Key in *Suwannee River* tell of their regions with effectiveness and with a simplicity appropriate to folklore. Each book has an index and a bibliographical discussion, and *Suwannee River* again meets a special interest by including a list of birds and flora. Finally each volume includes Constance Lindsay Skinner's excellent essay on "Rivers and American Folk," which outlines the series' purpose and discusses the influence of rivers so suggestively that it has seemed worth re-reading in each volume.

Geographer Appointed

Dr. John Kirtland Wright has been appointed Director of the American Geographical Society to fill the vacancy left by Dr. Isaiah Bowman when he left to assume the presidency of Johns Hopkins University. Founded in 1852, this Society is the oldest geographical society in the United States and the leading research institution of its kind. Its headquarters are at Broadway and 156th Street, New York.

THE FILTHY (?) FLY

by James D. Perdue

An ordinary house fly just landed on my typewriter paper. Pausing to watch him I could not help wondering about the injustice of that epithet "the filthy fly". Perhaps because today is Sunday, but probably as just a part of his daily routine, he was giving himself a thorough scrubbing.

First he completely and carefully cleaned the top surface of his wings. His agile hind legs repeatedly scoured the wing surface, and then brushed each other to remove all traces of invisible dirt. The same energetic legs then attacked the underside of the wings with such vigor that they seemed likely to break those delicate structures. After many alternate cleansings of the wings and legs the fly was apparently satisfied with the condition of that part of his anatomy.

His "face" was next. Much in the manner of a fastidious cat—but working more rapidly and with both front feet at once—he gave his face such a treatment as would make any small boy shudder in sympathy. His bulging and many-faceted eyes, his tongue-like proboscis, in fact his entire head, with all its appendages, were thoroughly "washed". But the process was frequently interrupted as he re-cleaned his front legs and feet. For how could he properly wash his face if his hands were dirty?

Watching curiously to see what would be his next procedure I was disappointed as he modestly retired to the other side of the paper. Perhaps he resented my intrusion on his privacy—or more likely he misinterpreted a restless movement of my hand. In any event he departed. But he left me thinking that perhaps the fly is a much misunderstood creature—it is so easy to misunderstand.

Of course the fly is a dangerous germ carrier, and as such he merits no defense. Yet perhaps we do foster a misconception of the fly's personal habits. As an individual living creature he deserves more appreciative understanding.

Bad Chemistry

In our December issue we were guilty of some bad chemistry through the article "The Ghost City of the Algae" by John Fawcett. Coming to us with the assurance that it had been checked by authority we accepted it as such and did not further check the chemistry involved. We allowed Mr. Fawcett to say that the pinnacles in this formation consist of pure calcium. Neither pure calcium nor impure calcium exists in Nature. They cannot because the metal rapidly changes to the hydroxide or carbonate when exposed to air. We also stated that the algae extracted carbon dioxide from calcium hydroxide, precipitating calcium. There is no carbon dioxide in calcium hydroxide. What the algae did was extract carbon dioxide from the calcium carbonate in the water. The residue would then be calcium oxide, which would immediately hydrolyze to calcium hydroxide, which would build up as stated. We are indebted for this to W. D. Green of the Combined Metals Reduction Company of Stockton, Utah, and, right now, our high school chemistry teacher is turning over in his grave for shame of us. Mr. Green offers the further observation that "the 'strange crags' undoubtedly are now composed of purest calcium carbonate and not 'purest lime'."

Exchange Snakes?

Wilfred Neill, who lives at 2518 North View Avenue, Augusta, Georgia, writes us that he has a collection of more than two hundred living snakes and that he would like to correspond with others interested in reptiles with a view to exchanging ideas or specimens.

More Martins Seen

We have received several reports from readers following our request for their experience with martins during the past few years. All of them seem to confirm the report of R. E. Gettys in our August-September issue that there is a growing scarcity of the birds in some places. Raymond J. Fleetwood of Madisonville, Kentucky, however, reports several large flocks of migrating martins this year. A new martin house he put up in the spring of last year was occupied by one pair of birds. Mr. Fleetwood writes that these first arriving martins were observed on March 19, 1938, but that the hospitality of his house was not accepted until mid-May, although other martin houses in town were occupied earlier.

Always Christmas

Clarence Hawkes is a Nature lover to whom the sight of the beauties of Nature are denied. Perhaps in compensation therefor he is more sensitive to Nature than are many of us more happily equipped. He has found great joy in writing, and the latest volume from his pen is *Christmas All the Year*, a collection of poems. The book is published by Christopher Publishing House, Boston, at $1.25.

New England Naturalist

Under date of December, 1938, the *New England Naturalist* made its bow to the field of natural history publications. Published by the New England Museum of Natural History, it is an expansion in size and scope of the former Bulletins of the Museum. We can find no indication whether this it to be a monthly or quarterly publication beyond the subscription price, which is ninety cents, and the single copy price, which is twenty-five cents. This would indicate quarterly appearance. The new little magazine will deal primarily with New England natural history and will permit a wider variety of material than did the Bulletins. The editor is Clinton V. MacCoy and the address of the Museum is 234 Berkeley Street, Boston.

California Woodpecker

The California Woodpecker and I is the intriguing title of the book that its author, William Emerson Ritter, further titles "A Study in Comparative Zoology". He says in his introduction that this is "an amateur's book, by amateurs for amateurs". Where professionalism has crept in it is expressed in terms "congenial to amatuers". The result is a fascinating book about an intensely interesting bird, written in human terms. It is published by the University of California Press at $3.50.

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This is written in one inch—the smallest display advertisement accepted in this magazine. Small advertisements of one or two inches produce results of many times their cost for hundreds of companies or individuals who have novelties, scientific or mechanical equipment, tools, games, puzzles, etc., to sell. Inch advertisements like this cost $14.00. They pay well because they are seen and read by 65,000 subscribers (approximately 250,000 readers) every month. Interested parties are invited to address the Advertising Department, NATURE MAGAZINE, 1214 Sixteenth Street, N. W., Washington, D. C.

The ASSOCIATION

In order to bring up to date the information contained in its illustrated booklet, *Birds of the States,* the American Nature Association has just completed a careful check with the Secretaries of State of the various States. A corrected listing as of January 1, 1939, reveals that 25 State Legislatures have officially adopted State Birds into the family of other State emblems. In six other States, and the District of Columbia, an official bird is recognized. Washington and Wisconsin have, respectively, chosen the willow goldfinch and the robin, by officially-sponsored school votes. The Governor of Oregon, in 1927, proclaimed the western meadowlark. The brown pelican was adopted in the State Seal of Louisiana in 1902. The service of the sea gulls in saving the crops of Utah from grasshoppers made the California gull the bird of that State, and a monument stands in Salt Lake City in commemoration of this service. By long custom the Baltimore oriole has been the bird of Maryland. In 1927 the Commissioners of the District of Columbia designated the woodthrush as the bird of the Federal City.

Connecticut is the only State in which no State Bird has been designated either by popular vote, by the action of important organizations within the State, or by any sort of official recognition. The States in which birds have been proposed by popular action but in which no legal recognition has been given are Delaware, Massachusetts, Minnesota, Mississippi, Nevada, New Hampshire, New Mexico, New York, North Carolina, North Dakota, Oklahoma, Rhode Island, South Carolina, South Dakota, Vermont and West Virginia. Members of the American Nature Association in a position to further legislative action in these States are urged to lend a hand.

•

Undoubtedly many members of the Association plan to visit the New York World's Fair this summer. In some cases living accommodations may not be easy to find. Your officers have carefully checked Registered Rooms, Inc., 551 Fifth Avenue, New York, and are enabled to offer their facilities to those lacking hotel accommodations. This organization has inspected a large number of rooms and suites, listing only those meeting with careful scrutiny. Prices will be kept at a moderate level.

•

The latest issue of the *American Nature Association Quarterly Bulletin* is now available to members requesting it. Dealing with the important issue of pollution, which will be actively before the new Congress, this has been written by Kenneth A. Reid, Manager of the Izaak Walton League of America and long an important figure in the fight for pure streams.

Membership Application Blank

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Yosemite Field School

Preparations are now being made for the fifteenth session of the Yosemite School of Field Natural History to be held this summer from June 26 to August 12 in Yosemite National Park. A distinguished staff drawn from Park Service personnel and nearby universities will share in the instruction which is conducted primarily in the field. One week will be spent on a park Research Reserve project and two weeks on a back-country pack trip for the study of flora, fauna and geology of the High Sierra. This school is maintained each summer by Yosemite National Park, under the Department of the Interior, to train men for naturalist work in the National Park Service.

Fourteen men and six women possessing the requisite training and experience in natural sciences are to be selected. College graduation, or the equivalent, is required. Majors in the science field are preferred. No tuition fee is charged and cost to the student involves travel to Yosemite and incidental camping expenses. Write to the Superintendent, Yosemite National Park, attention Park Naturalist, for a prospectus and application blank.

Lapland Bear Filmed

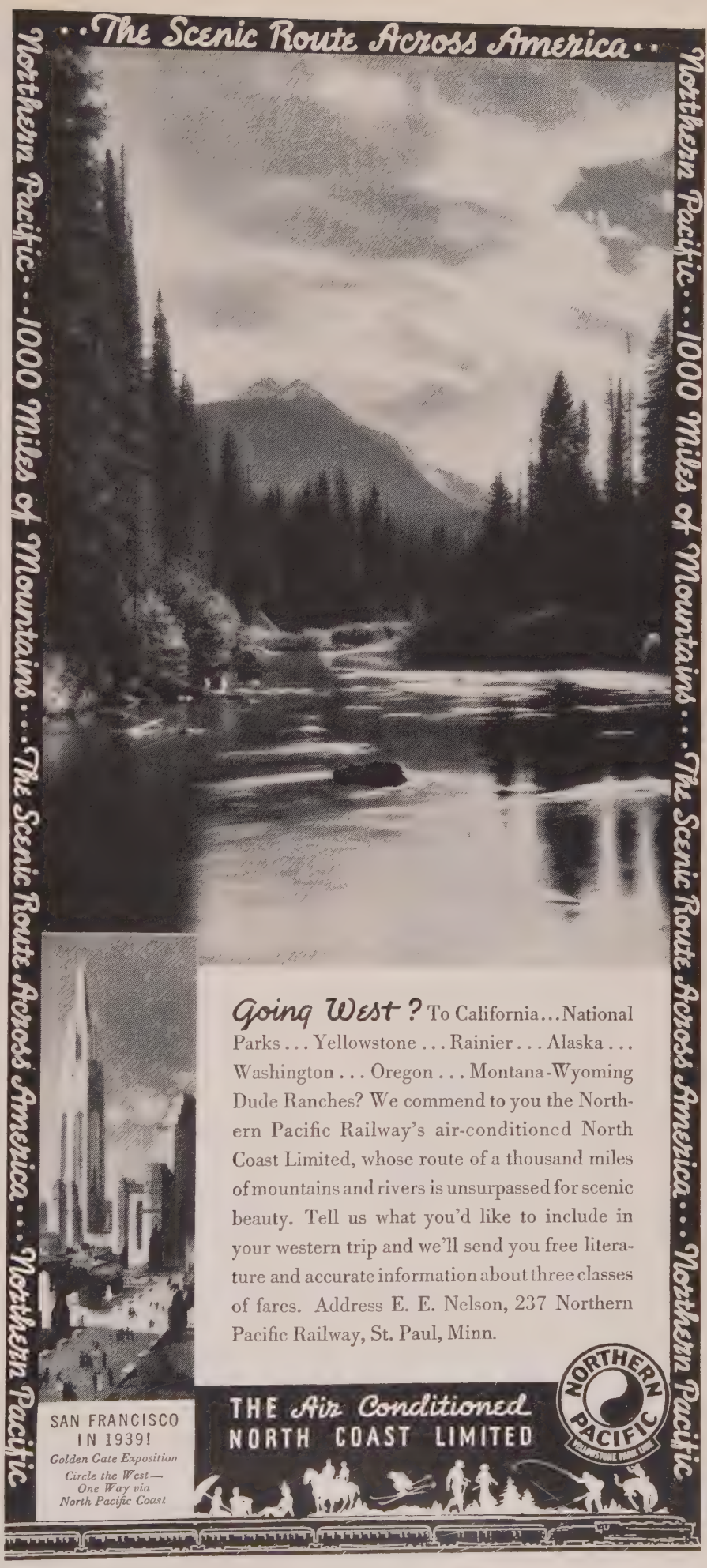
For the first time the elusive Lapland bear has been photographed in its native habitat. This was accomplished by Stig Wesslén, Swedish photographer of wildlife, who led an expedition for this very purpose. After many failures, Wesslén finally came upon a mother bear and three cubs, one of which was an albino, and was able to get excellent motion picture records of the mother, the cubs, and all four together.

Arctic Mysteries

Men and women have, of recent years, winged out over ocean waters and disappeared into the unknown. Yet in these cases there is a finality because we know that, probably without exception, they have joined the surging sea, quickly we trust. In the annals of exploration, however, men have set forth into the Arctic, many to return, but some to be lost under circumstances that intrigue the imagination. Five such incidents form the basis for an intensely interesting book by Vilhjalmur Stefansson entitled *Unsolved Mysteries of the Arctic*. The author and explorer deals with the disappearance of the Greenland colony, the lost Franklin expedition, the strange fate of Thomas Simpson, the disappearance of Andrée, and the missing Soviet fliers. There is an introduction by Stephen Leacock, long a friend of the author and an ardent armchair explorer of the Arctic regions. The book is published by Macmillan at $3.50.

Hoosier Club Elects

At the annual meeting of the Nature Study Club of Indiana Mrs. Harry H. Coburn was elected president and Mrs. Sarah Wager vice-president. The new secretary is Miss Anna Louise Cochrane, 3031 Kenwood Avenue, Indianapolis.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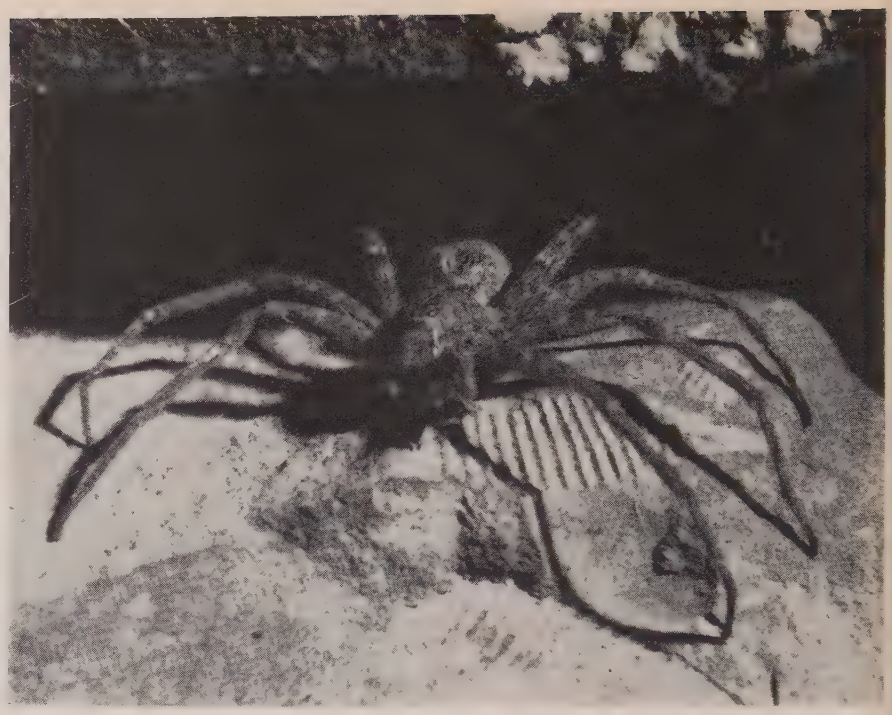

"ARACHNIDS, PAST AND PRESENT"—A LEICA PHOTOGRAPH BY ORLIN W. DONALDSON AND SHOWN AT THE INTERNATIONAL LEICA EXHIBIT

Nature photographers who are using flash bulbs either with a synchronizer or by the open flash method, have a tremendous advantage over those who depend entirely upon a fast lens and whatever light may be available. With flashes one can make exposures under any light conditions at sufficiently high shutter speeds to stop almost any motion with certainty of full exposure and the capture of all detail.

Flash pictures are of two main types; those that are made by opening the shutter, firing the flash bulb and then closing the shutter; the other, which is more convenient and flexible, involves the use of some apparatus for the synchronization of the shutter opening with the flash of light from the bulb. The open flash method requires only a camera of any type or design, and the mechanism, which anyone can put together, consisting of a socket and a reflector, a battery of at least two dry cells from an ordinary flashlight, and a switch device to complete the circuit. This type of mechanism is often used when the bulb is to be fired by the subject of the shot—as when a trap device is operated by an animal to take his own picture. To make pictures by this system, which naturally must be done in the dark since the lens is left open, the trap device, however it may be constructed, is connected to the flash bulb and the battery in a series connection in such a way that the springing of the trap by the animal completes the electric circuit thus firing the bulb. It is, of course, necessary to have the bulb either outside the field of view of the camera, or so shielded by the reflector, or something else between the light and camera, that the flash of light will not shine directly into the lens. The exposure will be determined by the distance from the bulb to the subject of the picture and not by the distance from the camera. The following table may be used to determine the proper diaphragm openings at any given distance. The table is based on the use of Super Pan Film with the No. 2 Super Flash Bulb, or the No. 20 Photo Flash Bulb, and is intended for pictures made out-doors, at night: 5 ft.—F/22; 7 ft.—F 16; 10 ft.—F/11; 14 ft.—F/8; 20 ft.—F/5.6.

It is generally not wise to attempt the use of only one bulb at greater distances, and it is understood that the above figures hold good only when the bulb is set in front of a good reflector. If the pictures are made in the average-sized room, diaphragm openings one stop smaller should be used, and, if the No. 1 (or No. 10) bulb is used, one stop larger will give better exposures. Other films will require other openings. For example, Panatomic would need one stop larger than the opening given in the table and Kodachrome two stops larger, while Super Pan Press or Super XX would require two stops smaller.

We must keep in mind that the table described is only for the open flash method and will give under-exposure if the values are used with the synchronizer and high shutter speeds. This is because the open flash method makes use of all the light given off by the bulb, while the synchronized flash method utilizes only that part of flash that occurs while the shutter is open. For this use, we need a synchronizing device that will, attached to the shutter of our camera, insure the action of the shutter during the flash. The shutter that we may use will vary with the kind of camera that we have. The Contax or Leica, for example, should be set at speeds of 1/200 to 1/500 of a second. An Exakta should be set at 1/25 or 1/100, and a Korelle at 1/200. Cameras equipped with a Compur shutter should be set at 1/100 or 1/200 of a second. These speeds are all high enough to stop any action we are likely to encounter and yet permit the use, at ordinary working distances, of sufficiently small diaphragm openings to give us very great depth of field and consequently sharpness over a large area. As was the case with the open flash, the diaphragm setting, and consequently the exposure, is determined by the distance of the subject from the light. Our method of computing the diaphragm opening necessary is based on the use of Super Pan Film and the No. 2 (or No. 20) bulb with the shutter set at 1/200 of a second, and the following table uses these conditions. If the No. 1 (or No. 10) bulb is used, the settings will be one stop larger and, if Super Pan Press Film is used, the settings will be two stops smaller. For example, the standard setting for 10 ft. is F/8. With Super Pan Film and the No. 1 bulb the setting would be F/5.6. The Super Pan Press and the No. 2 bulb would require F/16, and with Super Pan Press and No. 1 bulb it would be F/11. The table shows then: 3½ ft.—F/22; 5 ft.—F/16; 7 ft.—F/11; 10 ft.—F/8; 16 ft.—F/5.6; 20 ft.—F/4.5.

This table, too, assumes the use of a good reflector such as is supplied with the various types of synchronizing units, and is based on ordinary surroundings. If, however, we are taking pictures in a small room with light walls, where there is a great deal of reflecting surface to affect our exposure, the above diaphragm openings may well be made one stop smaller.

The bulb, for most purposes, should be above the lens and somewhat to one side of it in order to throw the shadows, which will normally be rather intense, behind the subject where the lens will not be able to see it. If the bulb is below the camera, the shadow makes a sort of black halo above the subject and detracts materially from our picture. In many cases, especially where faces are involved, we may achieve a more attractive effect by having our bulb 3 or 4 feet from the lens above and to one side of it giving a lighting which in its modeling is much more like that used for portraiture.

If we are to use a synchronizer, and we will find innumerable purposes for our camera thus equipped, we must purchase—though some of us might well be able to make our own—some sort of apparatus. Apparatus on the market consists of a switch device, a case containing the battery, and a socket and reflector. Some of them fire the shutter electrically and are operated by pushing a button on the synchronizer, while others fire the shutter mechanically as we would with a cable release. Either type may be used, but if we are going to try any trap devices, by which our intended victim will fire the outfit to take his own picture, the type of apparatus that sets off the shutter electrically will simplify our trap, for in that case we need only design it to close an electrical contact when the animal takes our bait, and this contact will operate both the shutter and the flash bulb, whereas, in the types that work the shutter mechanically, we must arrange a cable release or some makeshift device long enough to reach from the trap to the camera. We have assembled a series of pamphlets descriptive of the various types of synchronized outfits available, and with full instructions from the makers of the bulbs as to exposures. This entire set of pamphlets will be sent to any of the readers of this department if they will write to us and enclose a three-cent stamp.

So far we have had in mind principally the taking of animal and some other pictures of moving objects, but we will find that our flash outfit will have many other uses. Most interesting effects are made possible by such an outfit, even in brilliantly lighted places under the brightest summer sun, for we have all made pictures of the beautiful girl under the flopping hat at the beach and found that we were unable to get a proper exposure of both her shoulders and her face. With the flash gun we can depend on the sun to illuminate the shoulder while our bulb gives an adequate light for the shadow areas. Naturally, we would not dare suggest the amusing pictures that we can make at parties with such an outfit, for we have too often had difficulties in escaping with the whole skin after we have caught some of our friends under these conditions, but the user of almost any camera equipped with a flash gun will find his working range tremendously increased, and that he can make really good pictures under almost any conditions.

ENLARGING

(Continued from February)

We have reached the point where we have selected exactly the section of the negative that we wish to make into our picture, and have decided the exact angle and alignment of it. We have chosen the grade of paper with contrast that will best match our negative and give us the effect we desire, and we have made our test strip so that we know just how long the exposure should be. The next step is the making of the full-sized print. The exposure as given by the test is made for the right length of time and the print is then slid into the developer so that the action begins over the whole surface at as nearly the same time as is possible. The tray should be rocked during the development, which should continue for from 1½ to 2 minutes. Nothing is gained by watching the print develop. It is better to slide the print into the developer face-up, moving it a trifle to be sure that there are no air bubbles and that the entire surface is wet, and then removing the print, placing it face down again with a sliding motion. When the developing time is over, the print should be held by one corner and allowed to drain for a few seconds and then slipped into the stop bath in the second tray, where it should be moved about, or the tray rocked for the first few seconds so that the action of the stop bath will be uniform. After one minute in the stop bath the print is again allowed to drain and is then placed in the hypo bath. Here again it is important that the print be moved about occasionally, and it should remain in the bath for at least 15 minutes. After the first two minutes the white light may be turned on to inspect the print, but remember to return the unused paper to its envelope, or put it into one of the popular light-tight boxes that are now being sold, before the light hits it. In the light we can inspect the print to determine if we have it just as we want it. In many cases we will find that one area or another of the print is too light or too dark to suit us. If it is too light, it needs more exposure; if it is too dark it needs less, and we can make our changes on a second print with simple gadgets. A piece of wire bent at the end to hold an irregular shaped piece of cardboard or blotting paper will generally serve to hold back some small area that should be lighter during part of the exposure and, if it is the sky or the extreme foreground as is often the case, that needs to be printed darker, the envelope, in which the paper came, or a piece of cardboard torn with a rough edge, may be used to cover the remainder of the picture while the area we wish to darken is being further exposed. Do not attempt to do the extra printing—the "printing-in"—by laying the card on the surface of the sensitive paper as this leaves a definite line between the tones and shows our manipulation. Rather hold the card about mid-way between the enlarger lens and the paper, and keep it in motion while the exposure is being made. This will serve to blend the tones so that the final picture will not show that we have done anything to it. Changing the values by dodging, as holding back an area is called, or by printing-in is perfectly permissible photographic practice and often enables us to make a valued picture from a negative that does not permit a "straight" print, but it is a sure sign of poor workmanship and lack of artistry if our efforts to improve our picture are obvious. Therefore, we must do it carefully. Moreover, we must consider what changing some values in the picture may do to it as a whole, and it often happens that printing and dodging are carried to such extremes as to spoil the final effect. Here again the selection of just what we are going to do with our picture and to it depends on our artistic ability and our willingness to make enough trials to get the print exactly as we want it. Perhaps we might point out here that the modern idea of mass production is decidedly out of place in the making of prints. Good pictures are made by the exercise of judgment, thought, and care, and the man who comes out of his dark room at the end of an evening and boasts of the 50 prints that he has made may be perfectly sure that not one of those prints is as good as it might have been.

After a minimum of 15 minutes in the hypo, the prints must be washed until every trace of chemicals has been eliminated. This will require, for double-weight paper, a washing of at least an hour in running water. It is imperative that the water reach all parts of every print all the time. A pile of prints will not wash unless they are moved and the water is allowed to circulate between them. If the washing is not complete, the prints will soon develop brown stains and will bleach unevenly. If the washing is completed and we have been careful in each step of the process, we have a picture that will be a permanent source of pride and enjoyment. Later on we shall take up some of the tricks that may be employed for various effects, and consider the methods by which we may combine several negatives into one picture. Remember that if you have any such problem that is bothering you we would like to have a chance to help you.

This and That

Agfa Ansco have announced two darkroom accessories that will interest all of us—a printing frame that is adjustable for negatives from 1" by 1½" to 4" by 6". It masks the paper to give white margins around the prints, and is plainly marked to make the adjustment simple. The Masking-Print Frame, as it is called, sells for only $1.50, and may be found at your dealers. The other

(Continued on page 125)

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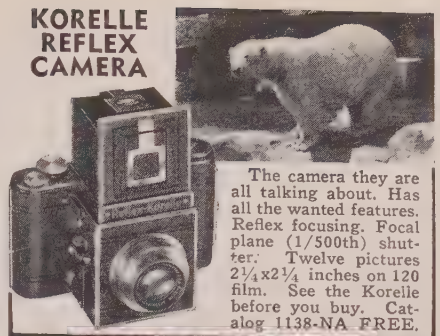

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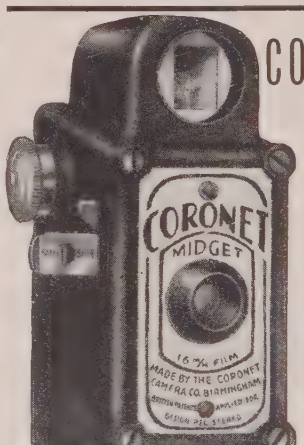

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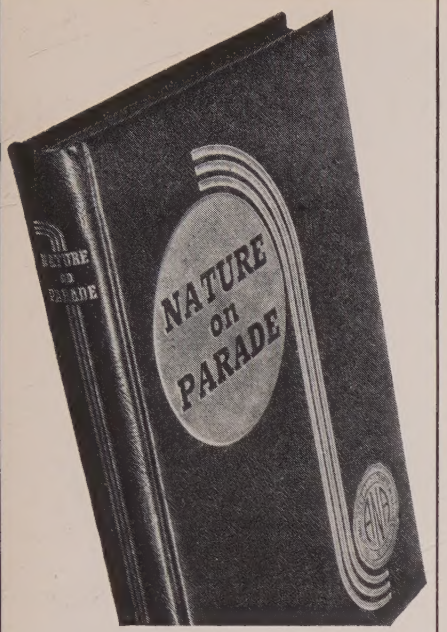

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(Continued from page 123)

dark-room help is a new safe-light lamp with interchangeable glass filters in green and red and a yellow bulb. The combinations possible make the light useful for any paper and for all films except those that must be developed in the dark. The complete outfit is priced at $1.95. Agfa Ansco Corporation, Binghamton, New York, will send an interesting set of circulars to any Nature reader on request. Please do not fail to mention this department.

The Kalart Company, 915 Broadway, New York City, whose information on flash bulb synchronizers will be mailed direct to you from this department, also make several range-finders attachable to ordinary view-cameras. A pamphlet describing their new Model 'F' Range-Finder is waiting for you. It may be put on any plate or film-pack camera whose lens has a focal length between 10.5 and 30 cm, and makes the focusing of such a camera as fast and as easy as though it were a miniature. Mention us when you write for your copy.

Burke and James, Inc., of Chicago are the importers of a camera that is especially adapted to the work of the Nature photographer, the Korelle-Reflex. The Korelle makes a picture 2¼" by 2¼" on the universally available #120 film, and works on the same reflex focusing principle as the Graflex. This system permits easy focusing with any lens and allows the photographer to see on the ground-glass exactly what will appear on the film. We have a supply of folders describing the Korelle, and will send one to you on receipt of a three-cent stamp. You will find it interesting.

For picture makers who want to hang or stand their work easily and attractively, the Braquette offers a good solution to the problem. We have six of them on the walls of our living room. Descriptive pamphlets await the Nature photographers' requests at Braquette, Inc., 225 Fifth Ave., New York City.

Panatomic-X, the new finest grain Eastman film, is now available in roll-film and film-packs. We have been using it with a speed rating of 21 Scheiner or 16 Weston and getting fine results. Higher ratings might be used, but there is danger of loss of detail in the shadows if we cut the exposures too much. The film has a fine color balance and plenty of latitude, and permits—with proper development—of tremendous enlargements. Your dealer has it.

Is your photographic equipment insured? If not, better look into the question. Loss or theft of the pet camera is no joke, and it always happens at the most inopportune time. Leslie D. Forman and Company of 84 William Street, New York City, have a folder describing the policies they can write to cover your filters, meters, cameras, and all the rest of the outfit which they will send you on request. Please don't forget to mention this department.

There is a lot of information on printing and papers in the pamphlet on the Printometer which has just been issued by the Research Engineering Company of 310 South Michigan Ave., Chicago, Illinois.

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Indoors and Out

By HOWARD ZAHNISER

THIS MONTH of March that includes the spring equinox was once first in the calendar. Outdoors, where there are no calendars hanging, it is still the first of the year. Life begins anew. Just as it is our faith that in that unknown first beginning all life had a common First Cause, it seems that there is no season when the common element in all living on the Earth is more apparent than in the spring—when life begins anew. We share the spring equinox with the alder catkin, the rue anemone, the spring peeper, the kingfisher, and the black bear, for we all live by the Sun.

It is a paradox that man, the creature who has removed himself farthest from direct participation in this common life of the Earth, is the one best able to understand his fellow creatures, and though thus able to profit through thought from the existence of other species, is the one most likely to exterminate some of them. It is a more hopeful paradox that this creature man is also the only one who consciously strives to prevent extermination and through sympathy with other creatures to understand them, himself, and even the mystery of life itself.

We grow up unconscious of these things. I remember distinctly the consternation and argumentative attitude of my very young friend Gordon Oehser when I remarked that most of the animals I saw at the zoo had clothes on and were walking around looking at other animals in cages. I remember also the dubious acceptance by adults of the suggestion that the importance of wildlife conservation depends in part on the possibility that some observation of a wild creature may result in a better understanding of our own lives and problems.

When the common lot of at least the higher forms of life does become the subject of thought, and writing, there are, of course, two possible errors—the endowment of wild creatures with human attributes, or the interpretation of men as merely animals. Both are apparently errors of extremes, for two recent writers have demonstrated that a true understanding may be approached from either direction. Felix Salten's *Perri* (The Bobbs-Merrill Co., $2.50) is pure fantasy in its manner of speaking, yet it contributes immensely to a good attitude toward man and his fellow creatures and a better understanding of both. Professor William Emerson Ritter speaks a language that although simple, fluent, and good-humored is still the language of science, yet he contributes to the same end in *The California Woodpecker and I: A Study in Comparative Zoology—In Which Are Set Forth Numerous Facts and Reflections by One of Us About Both of Us* (University of California Press, $3.50).

Felix Salten's book, a successor to the deservedly popular *Bambi,* is fiction with a squirrel for heroine. The principal characters are other wild creatures and a human child. The story progresses through dialog, yet admitting the privileges of fantasy the talk of the wild creatures is in character—expressing, that is, their characters as understood by one who has been a close and as far as humanly possible an understanding observer.

Donald Culross Peattie, who contributes a foreword, says that he believes *Perri* "was intended, as it is ostensibly written, for children," but he drops a suggestion of "modern allegory" in such scenes as that in which the blackbird says of the shrewmouse, "He hasn't a friend in the world," and Perri's mother replies, "He has nothing but enemies! He even hates himself. He murders his own brothers and sisters!" (Strangely enough, through some two-edged misfortune Peattie quotes the magpie as saying this about the fox.) Certainly it seems to me that the book is worth the attention of adults, not only for the discovery of hidden double meanings and the interest in a story, but especially for the enrichment of understanding. There is the delicate touch of genius in Salten's use of the character Annerle—the human child, whose conversations at the age of three with the wild creatures introduce the story. At the close of the book, "at the age of four, she talked the human language; and the language of the innocent forest creatures was gone like dandelion fluff in the spring breeze."

"If only human children could grow up with the memory of all the gentleness, all the patience and devotion, which they have had from living creatures! But when they grow out of the dawning of their lives, they forget everything. And they forget, too, that in babyhood, when they did not know the language of men, and only babbled it clumsily, they understood the speech of all innocent creatures."

Reason may in part compensate for the loss of innocence—reason and its companions knowledge and understanding. The deep possibilities of this compensation are marvelously apparent in Professor Ritter's most excellent work, written profoundly and authoritatively yet, for interest to adult readers, not suffering by comparison with a work of fiction. The starting point of Professor Ritter's inquiry, he tells, was an old yellow-pine log in which, he calculated, there were thirty-one thousand, eight hundred holes that had been punctured in its bark while the tree was standing—holes punctured by the California woodpecker for the purpose of storing acorns in them. But the book is also Professor Ritter's response to a charge put upon him by the late publisher E. W. Scripps to do his share "as a professional zoologist in helping men to fuller information about, and better understanding of, themselves." Thus doubly motivated, *The California Woodpecker and I* certainly accomplishes a dual purpose. It merits the attention of bird students for its specific account of one species, as well as its general discussions of the class Aves, and it merits a wide audience of general readers for its light on human nature and the relationships of all living creatures. The text itself is of such greatness that it seems trivial in this discussion to note that the book is provided with an index, a bibliography, drawings, photographs, a color illustration of (Continued on page 172)

"SWALLOWS SKIM THE TOPS OF THE
WATER WEEDS ALONG THE EDGE OF
THE POND. . . ."